APR 21 1958

APRIL 1958

PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

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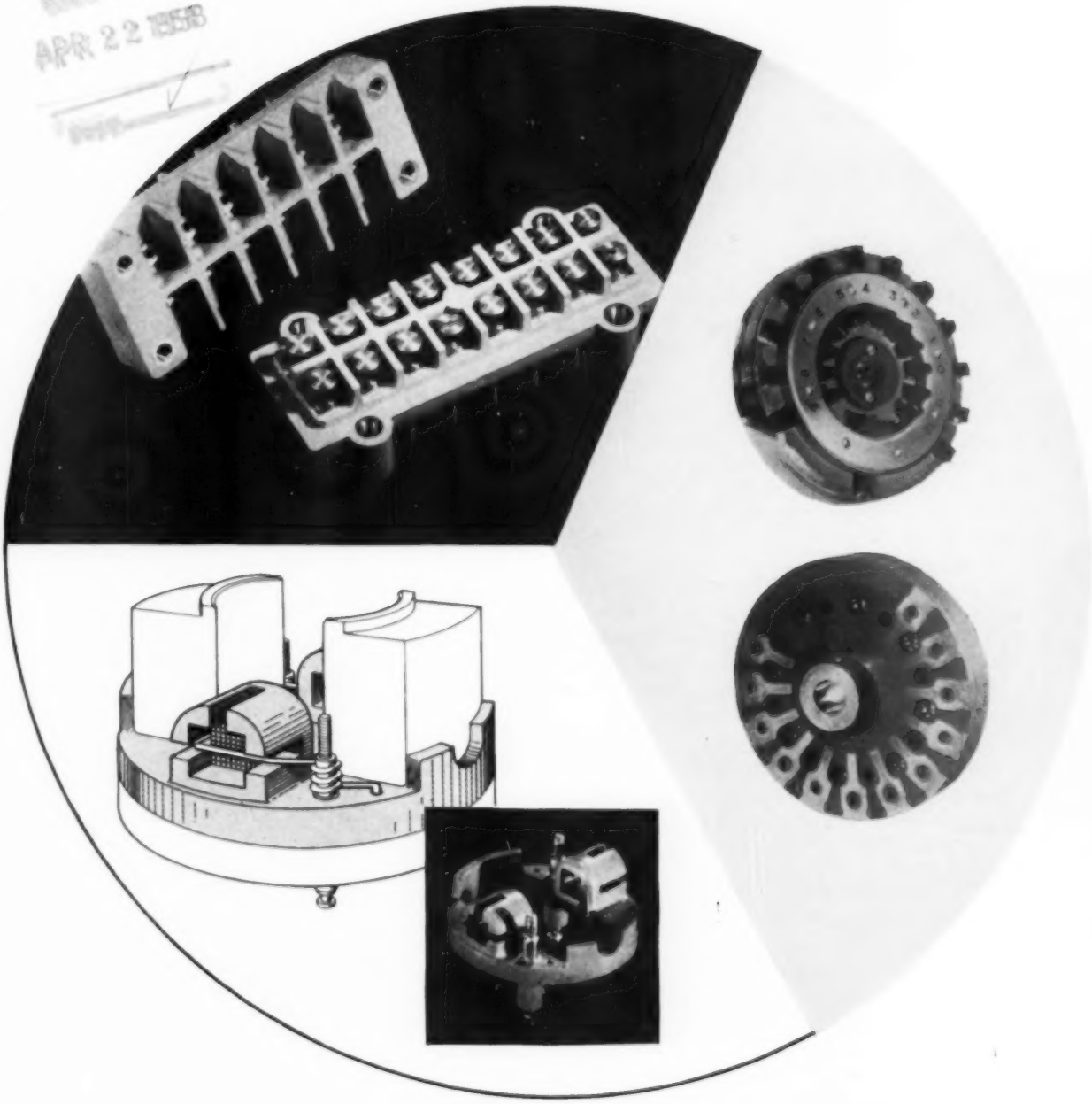


PLASTICS PERMIT PRECISION MOLDING OF AND AROUND INSERTS OF VARYING SHAPES

See Feature Story/page 358

A BILL BROTHERS PUBLICATION

EPON® RESINS

. . . *preferred for potting*

If potting, laminating, sealing or encapsulation are factors in your operation, you should investigate Epon resins. Because they provide a unique combination of desired electrical and physical properties, they are finding increased use in many phases of the electrical industry.

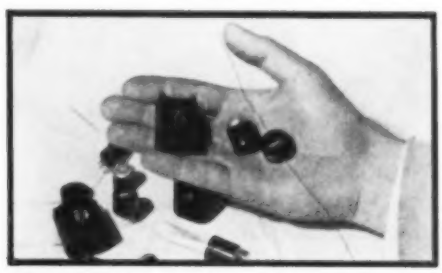
Potting and Encapsulation . . . Epon resins offer remarkable adhesive properties, forming strong bonds to metals and glass, and creating airtight enclosures for sensitive components and vacuum tubes.

Sealing . . . Epon resin-based compounds are ideal for moisture sealing even at elevated temperatures.

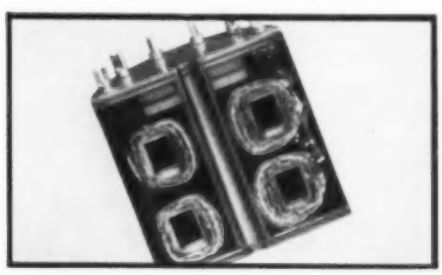
Laminating . . . Epon resin, laid up with inert fibrous fillers, produces laminates with superior dielectric properties and moisture resistance. Epon resin laminates can be dip soldered, sheared, punched and drilled, and provide *excellent dimensional stability.*

And, solvent-free Epon resin adhesive formulations . . . between glass, metal, or plastic . . . *cure at room temperature with contact pressure alone.*

Can Epon resins solve a production problem for you? For assistance and technical literature, write us now.



These miniature electronic components potted in Epon resin will withstand solder bath temperatures and retain excellent dimensional stability.



Sections of magnetic amplifier coils, when embedded in Epon resin, have exceptional resistance to solvents and chemicals

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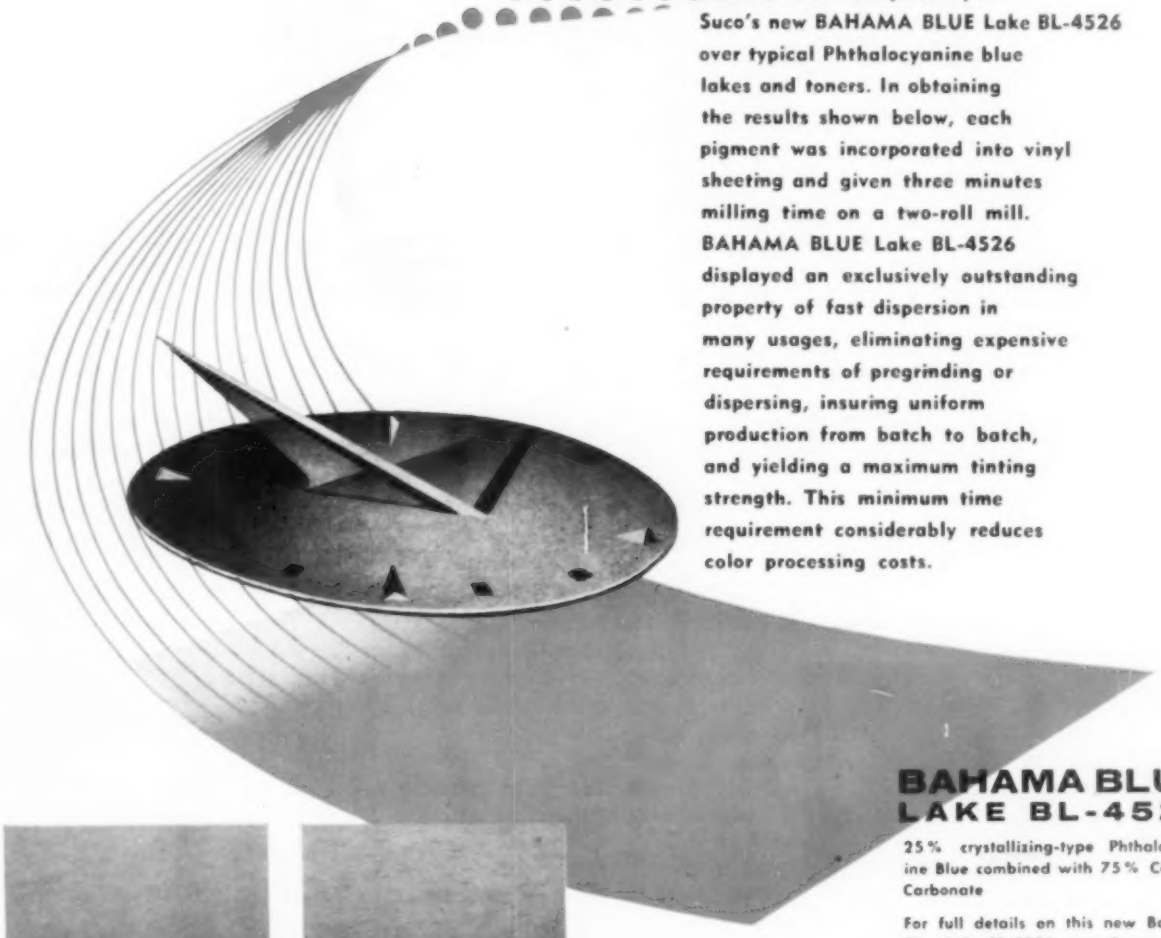
APR 21 1958

BAHAMA BLUE LAKE BL-4526

Lowers Color Processing Costs . . .

Laboratory comparison tests clearly demonstrate the superiority of Suco's new BAHAMA BLUE Lake BL-4526 over typical Phthalocyanine blue lakes and toners. In obtaining the results shown below, each pigment was incorporated into vinyl sheeting and given three minutes milling time on a two-roll mill. BAHAMA BLUE Lake BL-4526 displayed an exclusively outstanding property of fast dispersion in many usages, eliminating expensive requirements of pregrinding or dispersing, insuring uniform production from batch to batch, and yielding a maximum tinting strength. This minimum time requirement considerably reduces color processing costs.



A Typical Phthalocyanine Blue Lake

A Typical Phthalocyanine Blue Toner

BAHAMA BLUE LAKE BL-4526

25% crystallizing-type Phthalocyanine Blue combined with 75% Calcium Carbonate

For full details on this new Bahama Blue Lake BL-4526, *consult your SUCO representative*, as close to you as your telephone.

Standard Ultramarine & Color Co.

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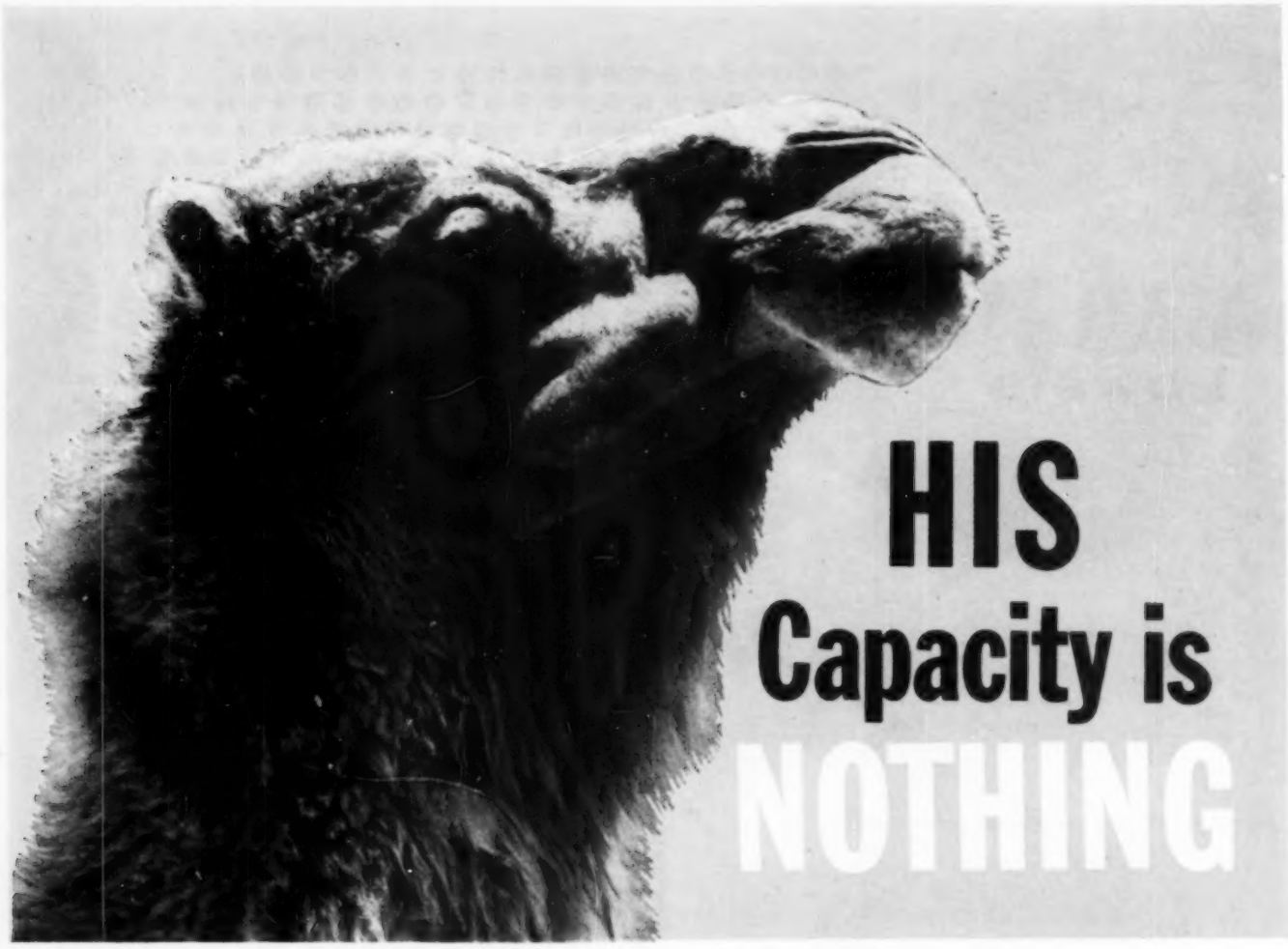
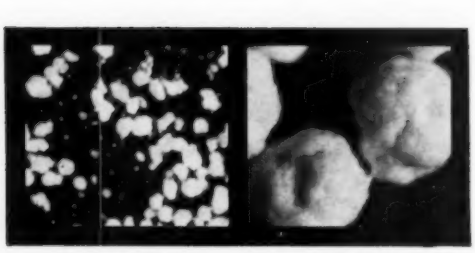


Compared With
ESCAMBIA PVC PEARLS*

FREE-FLOWING DRY BLENDS AT HIGH PLASTICIZER LEVELS FOR MORE PROFITABLE PRODUCTION

CAN YOU get a free-flowing dry blend using 50 parts of polymeric plasticizer? YOU CAN WITH THIS RESIN.

Dry blends handle almost like pelletized compounds and are easy to handle in your present equipment. Here are more profit-making advantages you get with Escambia PVC PEARLS—at no extra cost—



Competitive PVC *Escambia PVC Pearls*
(Each magnified 20 times)

- Complete freedom from fines
- Uniform particle size
- Outstanding heat stability
- Freedom from "fish eyes"
- Excellent color and clarity
- Fast mill banding characteristics
- Faster extrusion rates

*PVC Pearls is a trademark of Escambia Chemical Corporation. Manufactured in four molecular weights for all general purpose and many specific operations. For samples and additional information on this completely new PVC—write or call –

ESCAMBIA CHEMICAL CORPORATION

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PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

APRIL 1958 VOLUME IV NUMBER 4

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339 ROLL-NECK BEARING LUBRICATION FOR RUBBER AND PLASTICS CALENDERS *K. J. Gooch and W. C. Whittum*

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344 USE OF RADIATION GAGES IN PLASTICS EXTRUSION *G. I. Doering*

The source-detector units provide a simple read-out system that controls production, improves extrusion quality, and reduces costs of processing.

348 THE THIRTY YEARS OF PLASTICS IMPACT TESTING—PART II *R. F. Westover*

The conclusion of a two-part analytical discussion of past accomplishments and the present status of impact testing, and the outlook for the future.

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Letters to the Editor

Article

Highlights

Advances in Continuous Vacuum Forming Processes. (p. 335)

Since the origination of continuous vacuum forming, trimming or blanking has been the most controversial and least developed phase of the entire process. Some of the approaches to this problem are discussed, together with the influences of other design factors, such as size and shape of the plug; plastic sheet temperature; speed of plug insertion; and type of thermoplastic sheet used.

Rol-Neck Bearing Lubrication for Rubber and Plastics Calenders. (p. 339)

Results of tests made on Farrel-Birmingham's bearing test machine show performance of the bearing liner material to depend on such factors as load, speed, temperature, journal hardness, type of lubrication, and possible contamination.

Use of Radiation Gages in Plastics Extrusion Processes. (p. 344)

How radiation gages provide useful service in flat film, polylamination, and blown film extrusion processes are discussed in detail. Required controls for the processing of bioriented films also are mentioned. Data read-out systems and other trends of future development are mentioned.

The Thirty Years of Plastics Impact Testing—Part II. (p. 348)

This concluding section of the two-part article finishes the description and analysis of the present status of plastics impact testing, and points out the roads for future development of the test methods and processes. Impact testing must be considered from both the viewpoints of quality control and basic research on plastics.

Previews

The following articles will be published in the May issue, which will also include a special feature section on injection molding machines:

Early Detection of Weathering Damage in Polyethylene. J. W. Tamblyn, G. C. Newland, and M. T. Watson, research laboratories, Tennessee Eastman Co., Kingsport, Tenn.

End-Use Correlation of Styrene Container Testing. Bennett Nathanson, tech. service rep., Plastics Div., Monsanto Chemical Co., Springfield, Mass.

What A Plastics Engineer Should Look For When Planning To Buy An Injection Molding Machine. Gordon B. Thayer, Plastics Specialist, Plastics Technical Service, Dow Chemical Co., Midland, Mich.

Optimum Aromatic Amine-Hardened Epoxy-Glass Laminates. Harry Raech, Jr., and F. F. Harris, Northrop Div., Northrop Aircraft, Inc., Hawthorne, Calif.

Echoes Mr. Chester's Request

Dear Sir:

On page 192 of the March issue, Mr. Warren Chester requested information on a mirror-like lacquer.

If such information is acquired, we would be very grateful if we were informed of its source.

F. W. John, Works Engr.,
Turner Mfg. Co.
Chicago 23, Ill.

(Any information received for transmittal to Mr. Chester will be referred also to Mr. John—Editor)

• • •

Wants Plastic Boxes

Dear Sir:

We have been trying for some time to locate a manufacturer of plastic boxes who would be able to supply 85 boxes approximately five inches wide by 11½ inches long by 3½ inches deep; also 3½ by 9 by 2 inches, and 5 by 16 by 2 inches.

So far we have been unsuccessful. We would prefer a molded box with no covers or lids, however we would consider vacuum formed boxes. Can you give us any leads on this?

(Identity Withheld)

(All replies to the above inquiries will be forwarded to the questioners.—Editor)

• • •

An Author Thanks Us

Dear Sir:

I want to thank you for the complementary copy of PLASTICS TECHNOLOGY which you sent me, and to congratulate you and your staff for the excellent presentation of our article. (*"Measuring the Abrasion Resistance of Plastics Lenses for Sunglasses," by P. M. Klamath and H. O. Buzzell, Feb. 1958, pp. 132-6, 52*).

We have received many compliments on the article, and I believe these favorable comments are due, in a large degree, to the manner in which you presented the subject. We appreciate the cooperation you have given us.

H. O. Buzzell, Tech. Specialist,
Research Division, Polaroid Corp.
Cambridge, Mass.

(We take this opportunity to mention that every article author receives a complimentary copy of the issue in which his article appears.—Editor)

• • •

Seeks Plastic Vaults

Dear Sir:

I am writing to you in an effort to secure a source of supply for plastic vaults.

Thank you for your cooperation in this matter.

J. Esposito, Owner
Punxsutawney Ambulance Service
Punxsutawney, Pennsylvania

(Available companies are invited to either contact the inquirer or inform us.—Editor)

• • •

Another Compliment

Dear Sir:

In reading your magazine, I have noted that your editorial staff is maintaining a highly technical level of discussion in your articles. Far more so than other publications which cover the subject of plastics.

Curtis F. Pearl
Arnkurt Associate Engineers
New York, N. Y.

(We thank Mr. Pearl on behalf of our staff and our contributors who help us to maintain our publication level.—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation, and address.

A letter will not be printed if publication is not desired by the sender.

Letters requesting information on technical or engineering problems will be printed to elicit replies by the readers, either directly or through these columns. Upon request the identities of such "problem" letters will not be divulged.

—The Editor

"Quote . . . Unquote"

Cellulose Acetate for Thermoforming

"In the past three years, the use of cellulose acetate has tripled for forming applications. It is, in fact, the leading clear plastic material used for forming applications. There is good reason for this wide acceptance. It is the lowest cost material in the cellulosic family. Its toughness and clarity have been put to good use in many packaging applications. But low cost, toughness, and clarity alone have not made cellulose acetate a leader in the field.

Cellulose acetate is widely used because it is versatile in many ways. The thermoforming characteristics of this material are excellent. It is adaptable to all types of forming techniques using either mechanical, atmospheric or air pressure or combinations of these basic methods. No specialized forming machines are required. This is a factor to consider, especially in these times of rapidly increasing types of thermoplastic materials coming on the market. You also have a complete range of techniques to seal or cement this material. These include dielectric, impulse, and heat sealing. You may also use a wide variety of fast or slow acting solvents, cements, and adhesives to get permanent or pressure sensitive bonds.

Cellulose acetate lends itself well to many other fabrication techniques; such as die cutting and scoring, punching, beading and bending. It can be printed, hot stamped or sprayed. Recent cellulose acetate formulations have improved aging and non-yellowing characteristics to a point where this problem does not exist today. All of these versatile features and many more mean a lot to designers and production men who have to solve many problems in determining the possibilities of designs for their packages or products and how the best finished product can be made.

. . . This is not meant to imply that cellulose acetate is a panacea for all forming applications. The fact is, that like all other thermoplastics, it too has its limitations. However, limitations are sometimes relative. For instance, cellulose acetate is not generally used for outdoor applications, but the determining factor . . . depends on what length of service is expected. . . . . Cellulose acetate also has limitations as to the height or depth . . . (to which) it can be formed. . . . You must also take into account the gauge and cellulose acetate formulation to be used."

W. M. Ronayne, Market Devel. Engr.
Celanese Corp. of America
Plastics Div., Newark, N.J.

Plasticizer Data
TO HELP YOU CHOOSE THE RIGHT PLASTICIZER

this Harflex® Polymeric Plasticizer is permanent

Harflex 300 polymeric plasticizer

Non-migratory • Fast processing • Excellent dry blending • Good low temperature properties

Used with Vinyl Chloride Polymers and Copolymers, Polyvinyl Acetate, Synthetic Rubbers, Nitrocellulose, Cellulose Acetobutyrate, Polymethyl Methacrylate.

Can be used as sole Plasticizer

physical data

100% Modulus	1320 psi
Tensile Strength	2695 psi
Elongation	338%
Hardness, Shore A	80
T_f	−17.3°C.
Flux Time	45 seconds

heat stability (180°C.)

Initial Discoloration	15 min.
Maximum Discoloration	90 min.

extraction loss

Water	0.21 %
1% Soap	3.45 %
Mineral Oil	2.10 %

migration

Lacquer, 25°C., 14 days	Very slight softening
Varnish, 25°C., 14 days	No effect
Polystyrene, 60°C., 19 days	No effect

HARCHEM produces a full line of phthalate, adipate, sebacate and polymeric plasticizers. The Harchem Division laboratories will gladly assist you with your plasticizer problems, or will supply additional data including formulation test methods and formulation suggestions for any Harflex Plasticizer.

Address inquiries to Dept. H-43.00

THE KEY TO HARCHEM® BETTER PLASTICS

HARCHEM DIVISION

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M-32

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Announcing TYPE 2

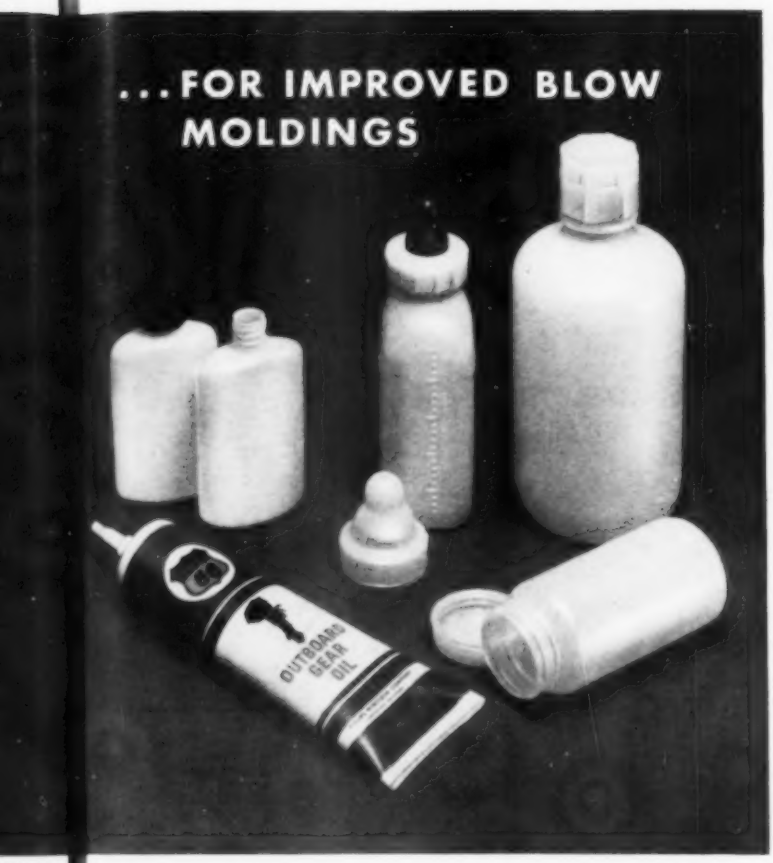
*MARLEX is a trademark for Phillips family of olefin polymers.

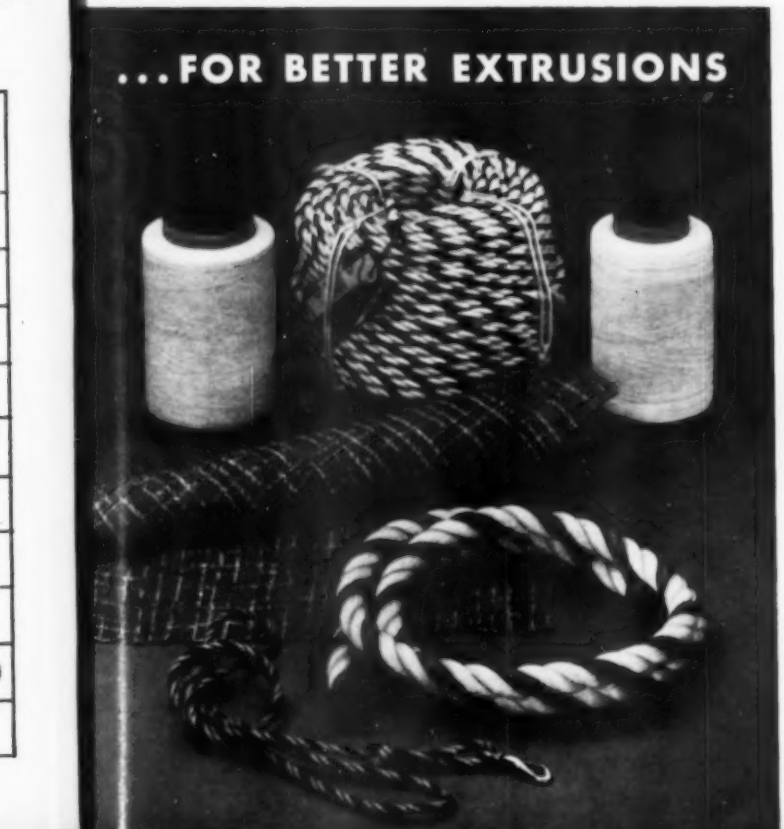
PHYSICAL PROPERTIES OF MARLEX

	NEW TYPE 2	TYPE 9	TYPE 15	TYPE 35	TYPE 50
MELT INDEX	**0.2**	0.9	1.5	3.5	5.0
IMPACT STRENGTH ½ x ¼ inch bar ft-lbs/in notch	**14.0**	4.0	2.5	1.5	1.2
ENVIRONMENTAL STRESS CRACKING Bell Laboratories Test, F_{50}, hours	**60**	14	10	2	1
BRITTLENESS TEMPERATURE 50%, °F	**<–180**	<–180	<–180	–150	–100
ELONGATION %	**30**	25	20	15	12
DENSITY	**0.96**	0.96	0.96	0.96	0.96
SOFTENING TEMPERATURE °F	**260**	260	260	260	260
TENSILE STRENGTH 20 in. min, psi	**4400**	4400	4400	4400	4400
STIFFNESS psi	**150,000**	150,000	150,000	150,000	150,000
HARDNESS Shore D	**68**	68	68	68	68

MARLEX* RIGID POLYETHYLENE

A new addition to our line





Type 2 MARLEX is a new low melt index extrusion-grade resin now available to plastics processors in commercial quantities. Compare the data on the five types of MARLEX. See for yourself the advantages Type 2 offers you for vacuum forming, blow molding and extrusion applications—greatly increased toughness . . . higher impact strength . . . improved resistance to environmental stress cracking . . . higher melt viscosity . . . better creep resistance.

If you vacuum form parts, you will appreciate the high melt strength of this new resin type because it minimizes sag. Large sheets are accurately formed with uniformly thick walls even in deep draw applications. The high melt viscosity of Type 2 MARLEX is also very useful if you extrude or calender sheet.

Greater creep resistance of Type 2 MARLEX improves products made with extruded filaments, such as rope and seat cover material. And its increased resistance to environmental stress cracking is tailored for blow molders and extruders making bottles and tubes for packaging foods and drugs.

If you would like a bulletin with further information on Type 2 MARLEX resin, please send coupon below. Or call your nearest MARLEX office.

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A Subsidiary of Phillips Petroleum Company, Bartlesville, Oklahoma

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Please send me your bulletin on the 5 types of MARLEX.

Name:_____

Position:_____

Firm:_____

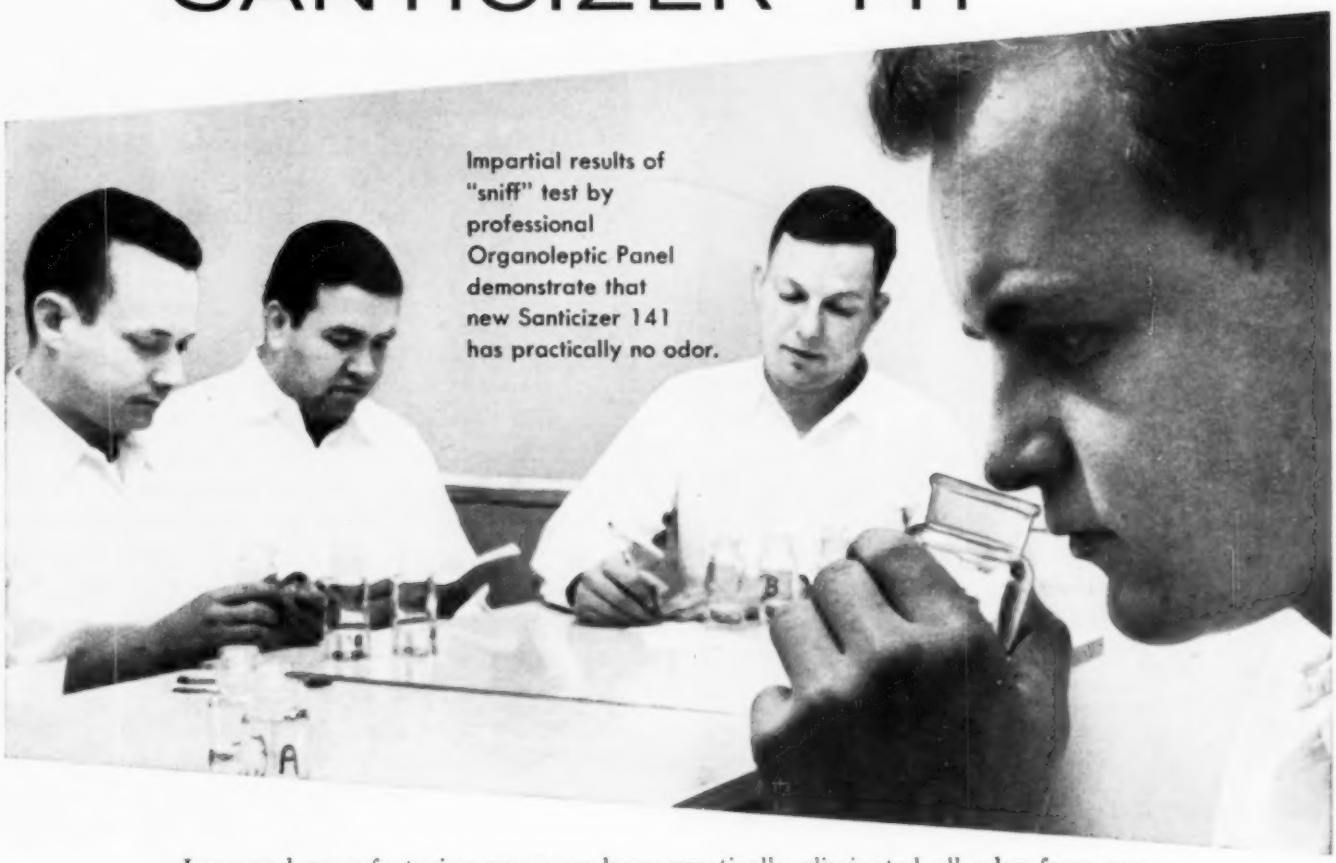
Street:_____

City:_____ **State:**_____

NEW from Monsanto!

Nontoxic, low-odor

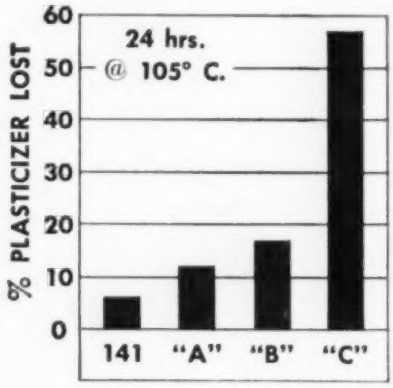
SANTICIZER 141


Impartial results of "sniff" test by professional Organoleptic Panel demonstrate that new Santicizer 141 has practically no odor.

Improved manufacturing processes have practically eliminated all odor from nontoxic Santicizer 141. With across-the-board approval for nontoxicity from the Food and Drug Administration and the Bureau of Animal Industry, low-odor Santicizer 141 can be used in your tubing, surgical supplies and packaging for aqueous, fatty or nonfatty foods. Santicizer 141 is a low-cost primary plasticizer for vinyl chloride polymers and copolymers, polyvinyl acetate, nitrocellulose and many other resins.

Check These 8 Advantages

- **nontoxic**
- **low volatility**
- **resists solvent, grease extraction**
- **high tensile, tear strength**
- **good low-temperature flexibility**
- **flame-retardant**
- **light-stable**
- **fast solvation, fusion**



Volatility Test Results. Low-odor Santicizer 141 is less volatile, more permanent than 3 major nontoxic plasticizers.* With very low volatility, good compatibility and high resistance to extraction, Santicizer 141 gives longer-lasting flexibility to beverage tubing, surgical tapes, shoe innersoles, packaging films.

*Names on request

Low-odor Santicizer 141 is one of seven nontoxic plasticizers Monsanto has for you. With no vested interest in any single nontoxic plasticizer, Monsanto develops plasticizing systems tailor-made to fit your needs. Write for full details and technical help, today.

Santicizer: Monsanto T. M., Reg. U. S. Pat. Off.

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In Canada: Monsanto Canada Ltd., Montreal

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Maximum jetness... maximum gloss for your black vinyl products... with

COLUMBIAN'S COVINYLBLAK-BA

This complete dispersion of carbon black (30% Neo Spectra® Mark II) provides...

TOP PRODUCT QUALITY

...gives you the utmost in jetness, gloss, strength and UV resistance.

PROFIT-MAKING ECONOMIES

...eliminates grinding...dirt, equipment maintenance... reduces labor costs... dry chips in concentrated form—a little goes a long way.

OUTSTANDING PERFORMANCE

...completely uniform, no variations from lot to lot.

● COLUMBIAN supplies Carbon Blacks in three forms: POWDER BEADS DISPERSIONS

COLUMBIAN CARBON COMPANY

380 Madison Avenue, New York 17, N. Y.

How to reduce your mold costs

D-M-E STANDARD MOLD BASES can reduce your mold costs in the design stage . . . during construction . . . and throughout the operation of the mold.

Mold designers can reduce drawing board time by using D-M-E's full-scale Master Layouts, which provide locations of leader pins, return pins, screws and other standard details. Complete catalog specifications and prices on 31 standard sizes—up to 23¾" x 35½"—eliminate guess-work in estimating the cost of the mold.

But your savings don't end there: Moldmaking time is turned into dollars earned, because all the plates in the assembly are precision ground—flat and square—ready for the moldmakers' layout and machining (pictured below). The exclusive inter-changeability of all D-M-E plates and component parts give you the added saving of immediate replacement in case of emergency.

For the molder, the use of higher grades of CLEANER steel in D-M-E Mold Bases means added strength and longer mold life. And D-M-E's range of standard sizes fit into *more* molding machines.

Start saving now . . . with D-M-E STANDARD MOLD BASES!

Over 1000 D-M-E STANDARD MOLD BASES are always IN STOCK at local D-M-E Branches ready for IMMEDIATE DELIVERY.

WRITE TODAY FOR 170 PAGE CATALOG

DETROIT MOLD ENGINEERING CO.

6686 S. McNICHOLS ROAD — DETROIT 12, MICHIGAN — TWinbrook 1-1300

Contact Your Nearest Branch FOR FASTER DELIVERIES!

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D-M-E OF CANADA	156 NORSEMAN AVE.	TORONTO, ONT.

METHYL ETHYL KETONE

Trays, tables, desks, lamps and many other pieces of fine furniture are being finished with acrylic lacquer to assure a durable and beautiful surface coating. One of the important solvents in this new lacquer is Methyl Ethyl Ketone, supplied by the Enjay Company.

Methyl Ethyl Ketone also plays an important part in automotive finishes. Car bodies finished with acrylic lacquers are almost chip-proof. For *your* solvent needs—specify Enjay M.E.K.*

**Methyl Ethyl Ketone*

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N.Y.
Other Offices: Akron • Boston • Charlotte • Chicago • Detroit • Los Angeles • New Orleans • Tulsa

ENJAY

Pioneer in Petrochemicals

FOR COMPLETE INFORMATION on specifications and performance characteristics of Methyl Ethyl Ketone, contact the nearest Enjay office. Shipments will be made from conveniently located distribution points in tank car, truck, or 55 gal. drum quantities.

Film of TENITE POLYETHYLENE offers "protection" in practical ways

The usefulness of film extruded from Tenite Polyethylene seems to be limited only by the ingenuity of designers.

Take the application shown here as an example. The tempting flavor of fried chicken is sometimes outweighed by the dislike many people have for soiling their hands. Now, thanks to these polyethylene mitts, they can have their fried chicken and eat it with complete enjoyment.

Fabricated from tough Tenite Polyethylene film, the mitts have a separate compartment for the thumb and extend well over the wrist. Because polyethylene is a good barrier to both grease and moisture, there's no chance for a diner to soil his fingers. And, since polyethylene is inexpensive, restaurant operators can provide these mitts free with every order of fried chicken or barbecued ribs. Similar mitts, by the way, are available for use in painting, gardening, and various household and industrial chores.

Film extruded of Tenite Polyethylene is a good choice whenever you need protection against water, grease or solvents. It is tough, resists puncture and doesn't tear easily. Its heat-sealability means easy, sure closing for packaging...or easy joining in fabrication of items such as these handy mitts.

Film of Tenite Polyethylene is available with a high degree of clarity and in a wide variety of colors. For more information on the many uses of film extruded from Tenite Polyethylene, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

TENITE
POLYETHYLENE
an Eastman plastic

Mitts fabricated by
Vonco Products, Inc.,
151 Hawley St., Grayslake, Ill.
Film extruded by
Flex-O-Glass, Inc.,
1100 North Cicero Ave.,
Chicago 51, Ill.

PLASTICS TECHNOLOGY

APRIL, 1958

EDITORIAL: Role of Salesmen in the Plastics Industry

The salesmen for plastics materials and processing equipment merit attention and editorial recognition for their important roles in the continuing advance of plastics technology.

There are two major factors worthy of consideration. Firstly, the salesmen are technically trained and/or educated. Many of them, in fact, have come out of the research and development departments of the materials suppliers, and the engineering staffs of the equipment manufacturers. Secondly, whether or not they are named only "sales representatives" officially, they actually are "sales service" or even "technical service" representatives, and are the direct line of liason between the manufacturers of plastics materials or equipment and the customers (plastics processors).

•

This second factor merits further elaboration. The service representative (to give him a more appropriate designation) calls on, and is called upon, by the processors. In his contacts, he becomes familiar with the problems facing his customers and, through them, the problems facing the industry. He does his best to help his customers in their plastics processing problems. When the specific problem is beyond his or their immediate range of capability, he refers it back to his company where the problem can be seriously and thoroughly investigated in the laboratories.

The value rendered by the "serviceman" to his clients is immediately apparent to anyone visiting a processing plant who has seen him begrimed and clad in overalls working on a molding machine, and as deeply immersed in the immediate problem as the processing plant superintendent or production man. And this despite the fact that the resultant order he obtains does not always warrant the time and effort he expends on the particular job.

•

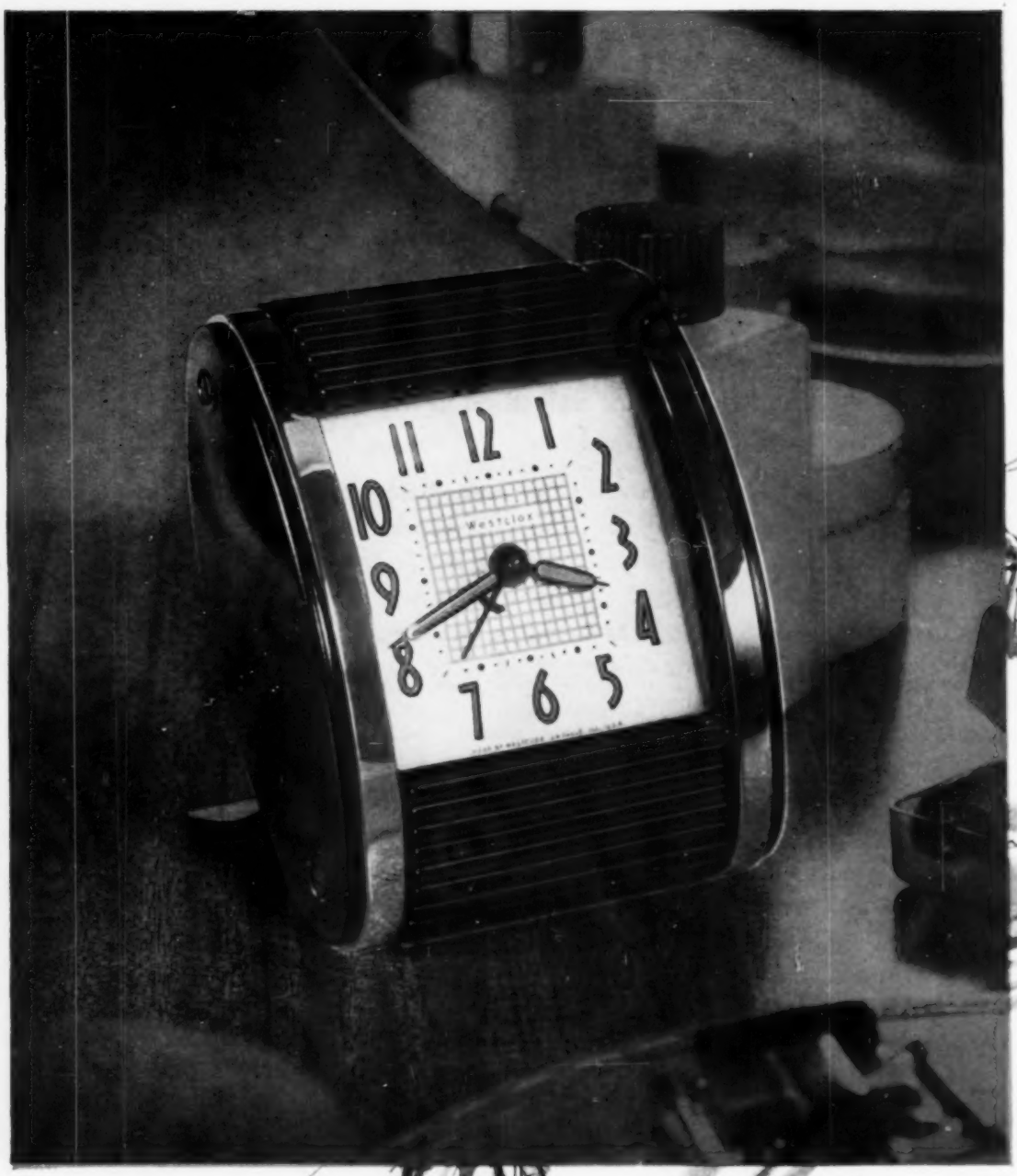
These "servicemen" must have been in painful agreement with our recent editorials inveighing against the peculiar and shortsighted "secrets" in the processing industry. Of course, the "servicemen" are only human, and they, as well as the rest of us, cannot be perfect at all times. Some "rotten apples" can exist, and damage the work and reputations of other salesmen. However, the great majority of salesmen are honest and integritous in their work to both their own firms and their customers.

There are too many processors who boast that salesmen are not allowed into the work areas of their plants. Instead of this, their motto should be "Know your salesmen and trust as many as you can to serve you and your interests to the best of their ability."

The salesmen deserve thanks and appreciation for their work as the "front-line skirmishers" in the continuing battle against ignorance in the technological advance of plastics towards the fulfillment of their roles as engineering tools invaluable to our civilization.

Arthur M. Merrill

Editor



TYPICAL PHYSICAL PROPERTIES OF FORTICEL

Flow temperature: (°C.) (A.S.T.M.)	D569-48	167–178
Specific gravity	D176-42T	1.18–1.21
Tensile properties:		
Yield (p.s.i.)	D638-52T	3380–5020
Break (p.s.i.)	D638-52T	3470–5240
Elongation (%)	D638-52T	56–66
Flexural properties:		
Flexural strength (p.s.i. at break)	D790-49T	6400–8500
Flexural modulus (10^5 p.s.i.)	D790-49T	0.23–0.30
Rockwell hardness: (R scale)	D785-51	62–94
Izod impact: (ft. lb./in. notch)	D256-43T	2.7–11.0
Heat distortion: (°C.)	D648-45T	59–70
Water absorption:		
% sol. lost	D570-42	0.00–0.08
% moisture gain	D570-42	1.5–1.8
% water absorption	D570-42	1.6–1.8

WESTCLOX SELECTS FORTICEL

Celanese propionate thermoplastic for its popular "Travalarm"

Trim cargo for the traveler, the Travalarm is a fashion-wise member of the Westclox family of precision-made electric and spring-wound clocks, pocket and popularly priced wrist watches. A handsome traveling companion, the Travalarm comes in either an ivory or black case of lustrous Forticel.

Westclox joins other famous name manufacturers like Zenith, Bissel, American Optical, Ansco, in selecting Forticel because this thermoplastic offers something more in a production material—the toughness and high speed moldability of the cellulosics, and the big plus combination of better dimensional stability, excellent form retention, freedom from unpleasant odor.

Properties like these can give your products an important competitive advantage, too. Write Celanese for complete data. Or, use coupon below.
Celanese Corporation of America, Plastics Division, Newark, N. J.
Canadian Affiliate: Canadian Chemical Co., Limited, Montreal, Toronto, Vancouver.

Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16 Celanese® Forticel®

Celanese
PLASTICS

Celanese Corporation of America, Plastics Division
Dept. 184-D, 744 Broad Street, Newark 2, N. J.
Please send me New Product Bulletin NP-16 on Forticel Plastic.

NAME_____
TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____

● This Isophthalic resin reinforced plastic duct combines light weight with high strength and superior resistance to corrosion. Fabricated by Peterson Products of San Mateo, California.

Super-tough plastic duct ...another **FIRST** for **ISOPHTHALIC** resins

Another new accomplishment with Isophthalic resins was the production of tough, light-weight ducting for a fume control system. Isophthalic resins were selected because of their superior performance. In this case, the plant required ducting that would last for years while in continuous service for controlling corrosive acid fumes. The answer proved to be an Isophthalic based plastic with superior resistance to corrosion.

This fiber glass duct, 25 to 36″ in diameter, 5/16-inch thick, fabricated in 3 sections totaling 130 feet, is extremely tough, yet light-weight—only 3000 pounds for the entire truck load shown above. A stronger laminate as well as better adhesion to glass fibers was accomplished with Isophthalic resins.

Superior wetting properties of Isophthalic resins reduced fabricating time and costs; the sections were quickly fabricated by using a contact layup over a male mandrel.

Isophthalic polyester resins with the epoxy strengths are continually solving tough application problems, providing the reinforced plastics manufacturer with new, years-ahead products. Contact your resin supplier or Oronite directly—see how Isophthalic resins can benefit the products you manufacture or market.

ORONITE CHEMICAL COMPANY
A CALIFORNIA CHEMICAL COMPANY SUBSIDIARY
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Foreign Affiliate: California Chemical International, Inc., San Francisco, Geneva, Panama 4833

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

Packaging Notes

Sealed Polyethylene Box Liners for apples have been found to eliminate weight loss, retard ripening and reduce scald of apples held in cold storage. Sealed liners were found to be superior to coated paperboard liners and unsealed liners for most varieties of apples tested. Research showed, however, that quality and uniformity of the film used played an important part in its effectiveness in lengthening apple storage life.

Poly Film to be Featured at National Packaging Exposition in New York, May 26-30. U.S.I. will introduce at the show a new polyethylene film of unprecedented clarity. The broad range of PETROTHENE polyethylene resins expressly developed by U.S.I. for packaging applications will also be demonstrated.

The show, sponsored by the American Management Association, is expected to attract more than 40,000 visitors. Exhibits will feature the latest in packaging machinery, materials and design. Technical sessions will also be held.

Theme of the U.S.I. exhibit at the show will be "PETROTHENE Polyethylene for clear, tough, protective film." U.S.I. Technical Service engineers will be on hand to answer questions on film processing and applications. Packagers and others interested in using polyethylene film can see extraordinary film clarity and toughness demonstrated at the U.S.I. exhibit. (Booth nos. 221, 225, 322 and 326 on the fourth floor of the N. Y. Coliseum.)

New York Coliseum, site of the 27th Annual National Exposition at which U.S.I. will introduce film made from its new high clarity polyethylene.

New Heat Seal Booklet discusses the factors involved in obtaining satisfactory heat seals on polyethylene film. The 16 page booklet is illustrated with 40 graphs showing how time, temperature, melt index, slip agents and resin density affect heat sealing. Heat seal characteristics are given for various resins in U.S.I.'s PETROTHENE polyethylene resin series. Copies of the booklet are available without charge to extruders, convertors and packagers. Write to U.S.I. for "Heat Seal Characteristics of Polyethylene Film."

New U.S.I. Plant Will Produce 75,000,000 lbs. of Polyethylene a Year

Houston Facility Scheduled for Completion Next Winter

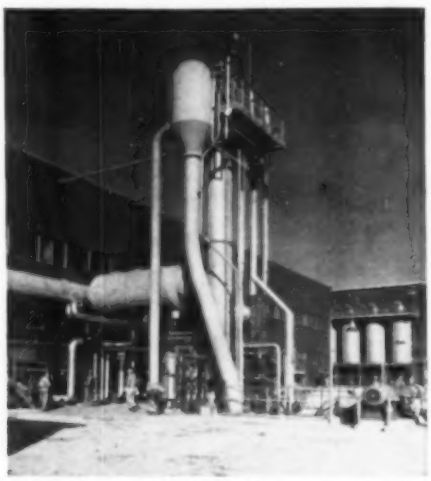
A second plant to produce U.S.I. PETROTHENE® polyethylene is scheduled to go on stream next winter in Houston. Capacity of the plant—75,000,000 pounds per year of intermediate density polyethylene resins—will almost double U.S.I.'s present polyethylene capacity. The plant at Tuscola, Ill., now has a 100,000,000 pound-per-year capacity.

Site for the new plant was selected to meet two prime considerations—easily accessible transportation for fast customer service, and a dependable supply of quality raw materials.

The 200 acre site on the Houston Ship Canal provides both. Shipments will be made by rail and truck, with the port facilities of Houston available for export orders. High purity ethylene will be piped in from nearby existing facilities of The Phillips Petroleum Company. Phillips will also supply the natural gas requirements of the plant.

The new installation will use a modification of the conventional high-pressure process, already proved in the Tuscola plant. Intermediate density resins will be produced, with properties somewhere between those of the original polyethylene resins and the new high-density resins produced by low-pressure processes.

National Petro-Chemicals is presently the third largest polyethylene producer in the United States. Petro has quadrupled PETROTHENE capacity in the past three years.



PETROTHENE polyethylene plant at Tuscola, Ill.

U.S.I. Assumes Full Control of National Petro-Chemicals

Full stock ownership of National Petro-Chemicals Corporation, producer of PETROTHENE polyethylene resins, has been acquired by U.S.I.'s parent company, National Distillers and Chemical Corp., from Panhandle Eastern Pipeline Company.

National Petro-Chemicals has been majority owned and managed by U.S.I. since its founding.

Saran-Coated Polyethylene Film Offers Improved Clarity, Lower Permeability

A recent evaluation of saran-coated polyethylene film indicates that as little as 0.1 mil of saran coated or laminated to polyethylene film gives improved clarity to the film and greatly increases its impermeability to oils, organic liquids and gases.

This latter property, especially, promises to open up new packaging applications to coated polyethylene film. It permits the packaging of such foods as processed meats and cheeses in either a vacuum or inert gases, and helps retard oxygen-caused rancidity and discoloration in packages containing fats, oils, dried whole milk and many other products. Reduced permeability to organic liquids and vapors would enable the film to increase the shelf life of pharmaceutical products and furnish better protection against off-taste and contamination.

The tests showed that similarly good results can be obtained with saran-coated polyethylene bottles and collapsible tubes.

IN THIS ISSUE:

P. 2—Polyethylene Coated Board—THE MARKET IS GROWING

P. 3—Predicting End Properties of Blended Resins

P. 4—How to Increase Your Market for Abuse-Resistance Products

Polyethylene Coated Board—

the market is growing

DETAILS ON BACK

Polyethylene extrusion-coated board is replacing conventional coated board in more and more applications. In packaging food and dairy products, furniture, chemicals, industrial parts, users are finding that only polyethylene offers all these advantages: EXCELLENT WATER VAPOR RESISTANCE • SUPERIOR GREASE RESISTANCE • HEAT SEALABILITY • GOOD ADHESION OF COATING • TOUGHNESS AND SCUFF RESISTANCE • WILL NOT SCRATCH OTHER SURFACES • PRINTABILITY • NO TASTE, NO ODOR, NO CONTAMINATION OF FOOD FROM COATING SUBSTANCE

In Polyethylene Coating, PETROTHENE® Resins Give You Top Results—

HERE'S WHY: PETROTHENE polyethylene resins are made at U.S.I.'s modern, integrated facilities at Tuscola, Ill., and have several important advantages over many other polyethylenes. PETROTHENE resins have good draw-down properties which enable you to coat at appreciably faster production rates. They give you good adhesion, with minimum hot melt oxidation. And PETROTHENE coatings have no taste or odor—an important consideration in many packaging operations. For all polyethylene extrusion coating applications, take advantage of the properties of PETROTHENE polyethylene. It costs no more.

U.S.I. IS HELPING YOU EXPAND YOUR COATED BOARD MARKET WITH INDUSTRY-WIDE ADS LIKE THIS—

To develop new markets and increase polyethylene coated board sales in present markets, U.S.I. is sponsoring a series of ads such as the one at left. These ads tell your customers about the market advantages of polyethylene-coated board. The series will run regularly in leading trade publications. For reprint copies of these ads as they appear, write:

U.S.I INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corporation
99 Park Avenue, New York 16, N. Y.
Branches in principal cities

Vol. III No. 2

POLYETHYLENE PROCESSING TIPS

PREDICTING END PROPERTIES OF BLENDED RESINS

A polyethylene processor may attempt blending of resins either for economic reasons or to attain a specific set of properties.

He may be successful, but blending, in general, is not considered good practice because it is difficult to obtain a homogeneous blend and the end results are difficult to predict – especially if the resins are from different manufacturers.

However, if you find it necessary to blend, it is possible to predict certain end properties with reasonable accuracy.

Melt index and density are predictable

Assuming that your polyethylenes are closely enough related, it is possible to blend for specific melt indexes and densities and therefore to obtain the desired properties that are functions of either of these.

The chart and the formula given here will enable you to predict either melt index or density. If you are blending for melt index, the logarithmic average will give the correct figure. Simply follow the directions in the caption under Figure 1. If you are blending for density, the arithmetic average will be correct. Simply use the formula described in the example given with Figure 2.

Recommended Precautions

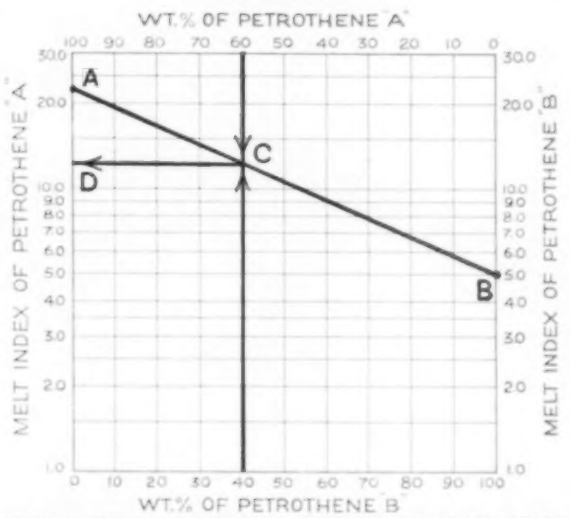
It is recommended that you limit yourself to injection molding when working with resin blends. If you are using a rotary drum for mixing, allow a tumble time of at least 20 minutes.

Shots should be relatively large, limited generally to about eight ounces in single cavity molds and twelve ounces in multiple cavity molds. Restrictive gatings, back pressure plates or similar devices, however, promote homogeneous mixing and sometimes smaller items can be effectively molded when these devices are used.

U.S.I. offers technical assistance

An answer to your individual need may well be found in obtaining directly from a manufacturer a polyethylene resin with the properties you want. And remember that U.S.I.'s Technical Service Engineers are always ready to work with you in finding the solutions to specific resin property problems.

FIGURE 1:



To Determine the Melt Index of a Blend of Polyethylene Resins having Different Melt Indexes –

1. Assume you are blending 90 pounds (60%) of U.S.I. PETROTHENE® 202 polyethylene resin with 60 pounds (40%) of PETROTHENE 201.
2. Petrothene 202 has a melt index of 22.0. On the left hand scale, therefore, fix a point at 22 (indicated by "A").
3. Petrothene 201 has a melt index of 5.0. On the right hand scale fix a point at 5 (indicated by "B").
4. Draw a line connecting 22 and 5.
5. Since you are using 40 percent of resin B(201), fix a point at 40 on the bottom and draw a vertical line.
6. From the point where these two lines intersect ("C"), draw a horizontal line so that it intersects the left hand scale ("D").
7. At "D" you now can read the melt index of your proposed blend.

This technique can be used to calculate the melt index of two polyethylene resins from the same manufacturer. If you do this type of blending frequently, you can set up these scales on any semilogarithmic graph paper. Your U.S.I. Technical Service Engineer will show you how.

FIGURE 2:

(% A) × Density of A + (% B) × Density of B = Density of blend

To Determine the Density of a Blend of Polyethylene Resins Having Different Densities –

1. Consider that you are mixing 105 pounds (70%) of U.S.I. PETROTHENE 206 (density 0.924) with 45 pounds (30%) of PETROTHENE 201 (density 0.916). Call resin 206 "A", and resin "201" "B".
2. Substituting these quantities and densities for the symbols in the formula above, you get the following numerical equation –

$0.70 \times 0.924 + 0.30 \times 0.916 = 0.9216$

3. The density of your blend therefore is 0.9216.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N.Y.
Branches in principal cities

HOW TO INCREASE YOUR MARKET FOR MOLDED POLYETHYLENE PRODUCTS...

We all know what a good plastic material we've got in polyethylene. It's durable, attractive and economical. But remember—the sales appeal of molded polyethylene products is based on SERVICEABILITY. In the long run, the size and growth of your molded polyethylene market depend on how well you build quality into your products. It's not an easy job. Here are a few typical problems that molders encounter frequently, and some of the suggestions that U.S.I. technical service people have come up with:

LOW TEMPERATURE FLEXIBILITY

Understandably, there's little market future for polyethylene garbage cans that shatter on a cold winter's morning. The secret of getting good low temperature flexibility lies in proper resin choice. Look for resins with low density. As far as melt index is concerned, the lower the better for low temperature flexibility—providing the resin can be molded without going to pressures that will cause locked-in stresses. Avoid unrelieved stresses caused by poor design or molding techniques. And use-test your finished product—theoretical resin brittleness values may not mean much under practical conditions.

Recommended PETROTHENE® resins: 202, 203, 206, 207.

STRESS CRACK RESISTANCE

Why will a polyethylene carboy safely carry sulfuric or hydrofluoric acid, while a housewife's dishpan may split from the chemical effects of ordinary household detergent? The answer again involves stress and choice of resin. Specifically, resins of higher molecular weight or lower melt index, and polyethylenes of narrow molecular weight distribution, such as Petrothene resins, have less tendency to crack under environmental stress. Residual strains left after molding will also have a marked effect on stress crack resistance.

Recommended PETROTHENE® resins: (for housewares): 200, 203, 205, 207.

SHRINKAGE AND WARP RESISTANCE

Molded products are moving into new markets where dimensional accuracy and stability are essential. Warpage in flat items, such as drainboards and large covers, is chiefly affected by molding conditions. However, resins of lower density and lower average molecular weight will have slightly less tendency to warp. Shrinkage, too, is a result of molding conditions, especially temperatures, but here again resins of lower density are less subject to shrinkage.

Recommended PETROTHENE® resins: 201, 202, 203.

For advice on specific molding problems and resin selection, contact U.S.I. Technical Service.

HERE'S HOW U.S.I. HELPS YOU TELL YOUR CUSTOMERS ABOUT THE MARKET ADVANTAGES OF QUALITY IN POLYETHYLENE PRODUCTS

In a series of ads like the one at left and in an illustrated booklet, "The Goose that Laid the Golden Egg," U.S.I. is presenting to buyers of housewares and other molded polyethylene products the reasons why quality is their best market booster. The ads and booklet emphasize the importance of well designed, well molded, serviceable products in maintaining consumer confidence in polyethylene. The program is designed to help tell your customers the advantages of dealing with you, the quality molder. Reprints of these ads and copies of the booklet for you to send to your customers may be obtained by writing to U.S.I.

U.S.I. INDUSTRIAL CHEMICALS CO.

Division of National Distillers and Chemical Corporation

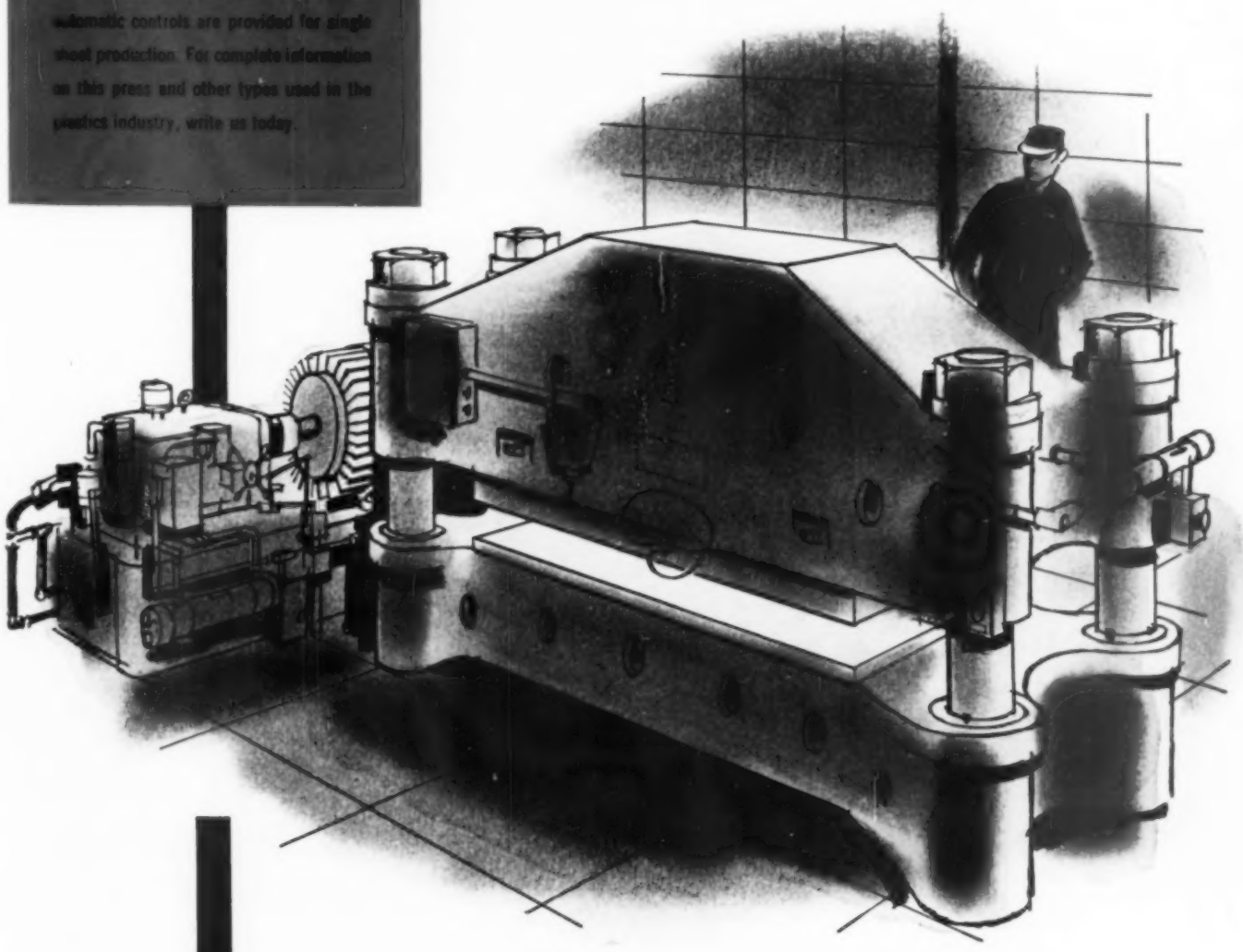
99 Park Avenue, New York 16, N. Y.

Branches in principal cities

Single Opening 500-ton Embossing Press for use on leather and plastic products. Fully automatic operation with suitable feeding mechanism permits pressing of sheets at rate of 12 cycles per minute. Semi-automatic controls are provided for single sheet production. For complete information on this press and other types used in the plastics industry, write us today.

Success is seldom accidental

People and products do stumble into success. But not often. The success of R. D. Wood Presses, for example, stems from unremitting attention to details. Every R. D. Wood Press is the product of sound design, carefully chosen materials, conscientious workmanship. This is why R. D. Wood Presses consistently deliver the utmost in smooth, dependable performance; fast, economical production; and trouble-free operation. And this is why so many leading press-users specify R. D. Wood.



R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA

A SUPERIOR

specifically designed for

IMPACT STRENGTH *and* STYLE

BAKELITE

BRAND

TGD-6000 STYRENE

This high-impact, rubber-modified extrusion compound is the result of a development program to provide extruders and vacuum formers with preferred features: strength, eye appeal and durability.

In addition this improved BAKELITE Brand Styrene extrudes at faster rates—has exceptionally high elongation values—possesses permanent high gloss and excellent rigidity. TGD-6000 Styrene is available in a wide variety of colors that retain stability even under heat polishing.

Write Dept. PT-28 for Technical Release #15 giving complete fabrication details.

TGD-6000 is particularly suited for use in refrigerator door liners for two important reasons: 1. *lustrous appearance and smooth surface* for eye appeal and ease of cleaning; 2. *high* impact strength, even at subnormal temperatures. TGD-6000 permits the use of thinner sections.

SUPERIOR EXTRUDABILITY

TGD-6000 is capable of fast extrusion, with high quality, on conventional equipment.

RECOMMENDED EXTRUSION CONDITIONS

Screen pack	20/60/80 mesh
All cylinders	350-400 deg. F.
Head temperature	400 deg. F.
Die temperature	420 deg. F.
Feed end	Cold water
Screw temperature	Neutral
Compound temperature at discharge	410-425 deg. F.

8-2028

STYRENE

TYPICAL PROPERTIES

Values Relating to Fabrication

Extrusion Compound Temp. at Die, deg. F.	400-425
Specific Gravity (D792-50)	1.04

Values from Mechanical Tests*

Izod Impact Strength (D256-56), ft-lb/in. of notch	1.0
Tensile Strength (D638-56T) psi	3400
Elongation in Tension (D638-56T), per cent	30
Flexural Strength (D790-49T), psi	8000
Modulus of Elasticity in Flexure (D790-49T), psi	370,000

Values from Miscellaneous Tests*

Thermal Coefficient of Linear Expansion (D696-44) per deg. C.	8×10^{-5}
Water Absorption (D570-54T), per cent gain in weight in 24 hours	0.12
Durometer Hardness (D676-55T), D Scale	80

*Values obtained from extruded sheet 0.100 in. thick

EASIER VACUUM FORMING

Because TGD-6000 possesses such excellent strength and elongation properties, sheets may be formed and deep drawn in highly detailed designs—without cracking, breaking or warping at corners. High gloss surface is maintained during deep-draw vacuum forming.

TGD-6000 affords extruders and vacuum formers design and production advantages to expand their facilities to include a broader range of specialized applications and new products. Suggested other uses include displays, signs, toys, television masks, appliance housings, guards and novelties.

BAKELITE BRAND **PLASTICS**

Products of UNION CARBIDE *Corporation*

BAKELITE COMPANY, *Division of Union Carbide Corporation,* 30 East 42nd Street, New York 17, N. Y.
The terms BAKELITE and UNION CARBIDE are registered trade-marks of UCC.

THE NUOSTABES

HEAT and LIGHT STABILIZERS

Your Certified Source of Supply

"Uniformity certified" appears on every container of Nuostabes® – your guarantee of top performance of vinyl products in processing and in use. This superior line of stabilizers contains the compounds best suited to your present requirements.

We invite you to call on our Technical Staff for assistance in specifying the Nuostabe you need. Extensive research and delivery facilities have made Nuodex a leader in the manufacture of Additives and S/P Chemicals — for more than 25 years. Write for our catalog and free samples of the products listed.

The multi-plant facilities of the Corporation are behind each Nuodex Product. Among those products of interest to you, in addition to the stabilizers here listed — are a complete line of metallic stearates and organic peroxides.

- DIBASIC LEAD STEARATE V-1
- LEAD STEARATE V-2
- BARIUM RICINOLEATE V-10
- BARIUM ZINC COMPLEX V-12
- BARIUM ZINC COMPLEX V-14
- CADMIUM LAURATE V-20
- CADMIUM V-21
- CADMIUM COMPLEX V-122
- BACAD LAURATE V-130
- BACAD (CO-PRECIPITATED) V-131
- BARIUM CADMIUM COMPLEX V-132
- BARIUM CADMIUM COMPLEX V-133
- CHELATOR V-40
- CHELATOR V-141
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NEWS in BRIEF

Nylon 6 plastics materials developed by Farbenfabriken-Bayer A.G., Germany, will be manufactured and sold here by Foster Grant Co. under the terms of a new license agreement. Until such time as F-G can install equipment to utilize the Bayer process, they will be permitted to import and sell these materials, both regular and special types.

New means of skin packaging that requires no special coating or perforating of the package board has been developed by Print-A-Tube Co., Rochelle Park, N. J. Utilizing a new film, Poly-on-Mylar Vacuumized, the development speeds the packaging cycle, and has opened the door to automation in skin packaging. The film can be used in gages as thin as 1-2.5 mils.

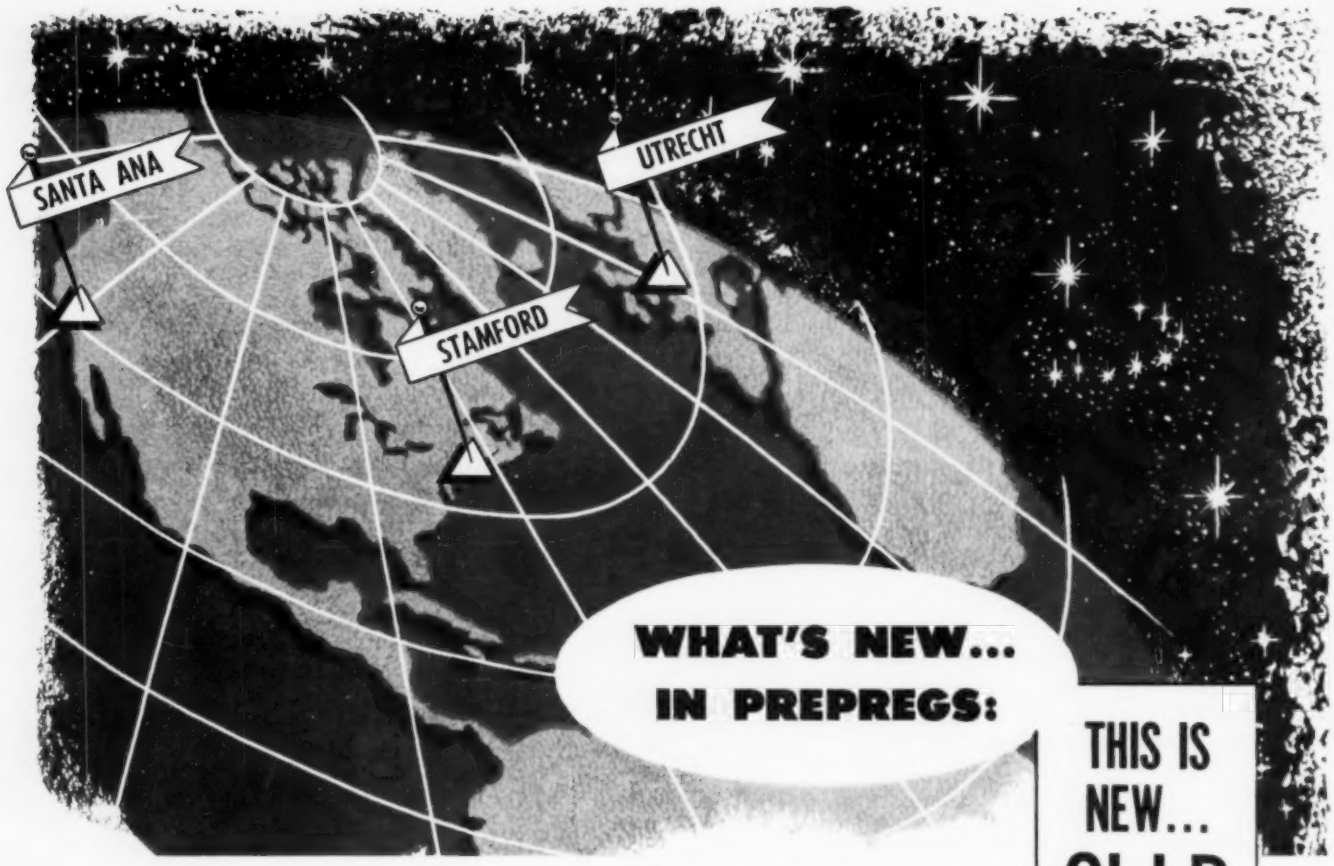
Business developments in the plastics industry continued to be varied in nature. A new firm, Techni-Plastics, Inc., was organized in Port Washington, N. Y., to engage in plastics thermoforming and fabricating. A decorative art department for reinforced plastics was formed by Formica. Taylor Fibre has eliminated its geographic price differentials for laminated plastics. Cyanamid International has been formed by American Cyanamid as its foreign operations division. Robinson, Lewis & Rubin, Inc., a new firm, has been set up in New York, N. Y., for forming and fabricating plastics sheet materials. Linen Thread Co. formed an Akron Plastics Division in Paterson, N. J., for production and sales of its closed-cell PVC foamed products.. Emery Industries has purchased Vegetable Oil Products Co.'s fatty acid producing Vopkolene division at Los Angeles, Calif.

Company expansions in the plastics industry showed no slackening in number. A product development lab and pilot plant for American Cyanamid's plastics & resins division is under construction at Wallingford, Conn. A 15-million pounds annually epoxy resin plant is being built at Marietta, O., by Bakelite. A 16,000-square foot wing has been added by Frank W. Egan & Co. to its facilities at Somerville, N. J. W. R. Grace opened two main labs near Clarksville, Md. Hasting Plastics' customer service facility at Santa Monica, Calif., was placed in operation. An automatic plant for pentaerythritol production was opened by Heyden Chemical at Fords, N. J. By installation of additional extruders, production of Teflon rod has been boosted by Tri-Point Plastics. Bakelite has placed on-stream a fully-automated plant for making high-density polyethylenes at Institute, W. Va., and plans the commercial production soon of Phillips'-type resins at another plant in Seadrift, Tex. Zenith Plastics has built a reinforced plastics radome test facility in Gardena, Calif.

New Materials of special interest (see pages 367-9): flame resistant flocking adhesive; water-dispersible polyvinyl acetate powder; two resins and a prepolymer for polyester foaming; plasticizer-stabilizer for vinyl and styrene copolymers; and six high-density polyethylenes tailored for specific processing techniques.

New Equipment worthy of attention (see pages 370-2): hopper-type combination preheater-dryer; infra-red oven sections; spring-loaded thermocouple; dumper for bulk chemical containers; laboratory-model electrostatic separator; sizing machine for high-precision planing of plastics blocks, sheets, and laminates; and bench-type punch press.

Plastics Applications to be noted (see pages 373-5): acrylic fiber plastic attachment for vacuum cleaning of venetian blinds; fiber-reinforced polyester statuary; portable telephone amplifier in molded butyrate case; pre-flocked styrene sheet vacuum-formed into package platforms; one-piece molded polyethylene laundry basket; printed saran film wrap for meats; molded insulated serving pitcher of modified styrene; molded glass-polyester mailbox; and two-piece, waterproof vinyl sports suit.



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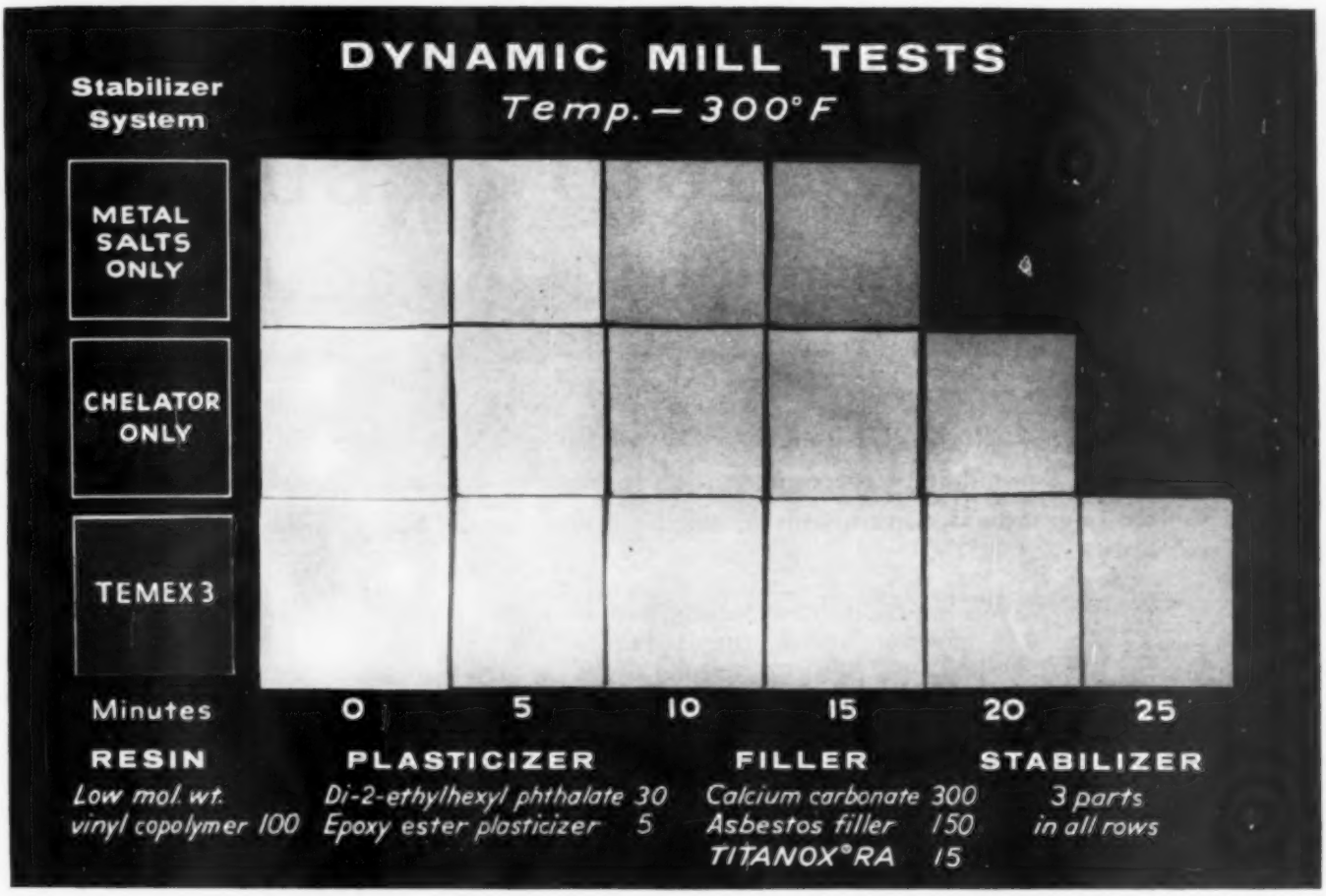

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Broadens the list of usable tints. The low reactivity of Temex 3 stabilizer does away with pinking, bluing and other undesirable color shifts. You are free to use both lighter and stronger tints.

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National Lead research has developed 20 other outstanding stabilizers for various types of vinyl stock. Among them, two more that are widely used in asbestos flooring stock . . . "Dutch Boy" Tribase and Normasal stabilizers . . . and one for non-asbestos flooring . . . "Dutch Boy" Clarite® A stabilizer.

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Better Help Assured

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PLASTICS TECHNOLOGY believes you would like to know about the bi-partisan Hoover Commission's recommendation to put business management methods into government departments operating under the Civil Service System

Departments using the Civil Service System operate under a balance that requires 1) politically appointed policy-making officials and 2) trained, skilled non-political staff members to carry out policy.

Career personnel, who know most about a department's operations, have the least to say about policies and programs. Non-career people, who know least about a department's operations, have the responsibility for operating decisions.

Here's what the Commission learned: There is no clear-cut division of labor between non-career (temporary) officials and career (permanent) personnel, and the result is inevitable loss of efficiency.

Genuine ability is often unrecognized...and incapable people are sometimes kept on the payroll too long...

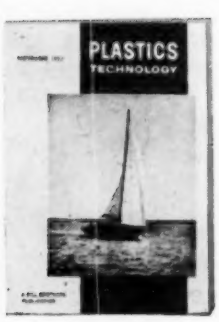
Turnover in personnel is too high... departments are losing the better people at an alarming rate...

Result of the Commission's analysis is the recommendation of a new and top flight career "Senior Civil Service"... a few thousand key administrators, scientists and technicians to be given status, rank, and better pay incentives. Such a plan, the Commission feels, would attract more capable young people, help retain experienced personnel, and improve the continuity and the caliber of work done. Savings in dollars would be considerable; savings in efficiency would be tremendous.

What you can do

This magazine, a member of *Bill Brothers Publishing Company*, presents this brief background as a service to its business readers. If you'd like more detailed information, the coupon below will start it on its way to you.

Meanwhile you should know that in this session of Congress H.R. 8207 awaits action by the House Post Office and Civil Service Committee, and S. 2290 by the Senate Post Office and Civil Service Committee. These bills would establish a Senior Civil Service to be administrated by an independent board of highly competent private citizens. If this makes sense to you, let your Congressmen know how you feel.



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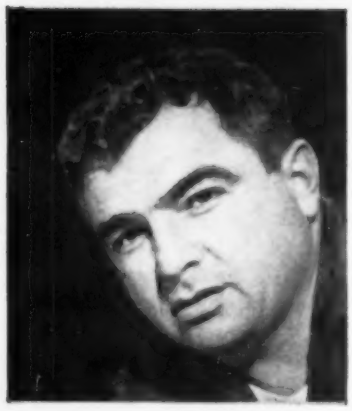

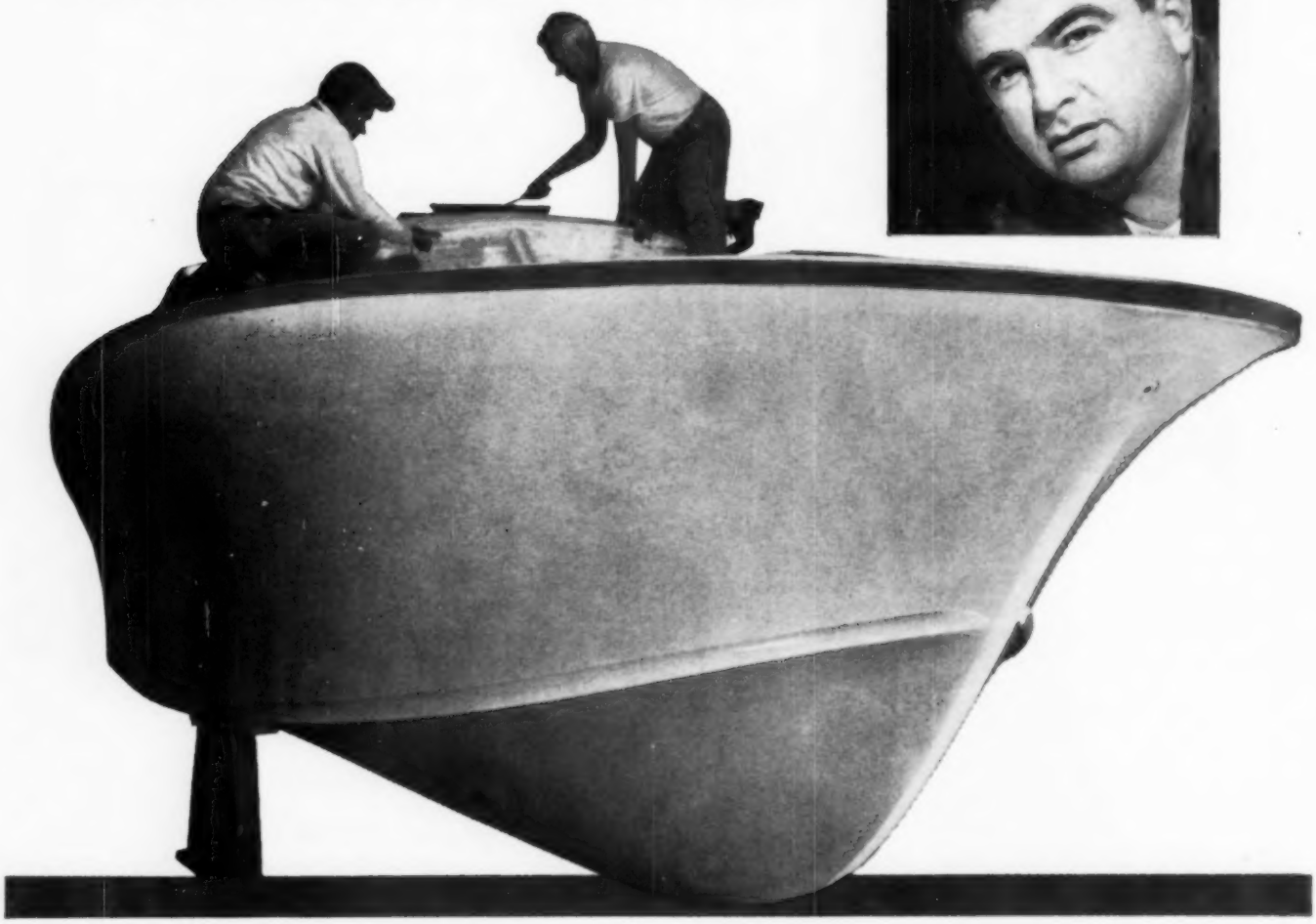

Why the American Hydroplane Corporation Chooses

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"We listed the properties we wanted in epoxy materials, and RCI came up with a resin to fit our needs." Speaking is Robert Hobbs, president of the American Hydroplane Corporation, Coral Gables, Florida, an engineering firm specializing in the design and construction of custom and prototype boats.

An unusual case? Not at all. It merely demonstrates the kind of helpful cooperation that you, too, can expect from RCI...*plus* a resin that suits your requirements to perfection.

As Mr. Hobbs put it: "The durability and dependability of RCI EPOTUF Epoxy Resins are very essential requirements in our production, of course. But another important reason why we use Reichhold resins almost exclusively (both epoxy *and* polyester) is the *constant technical service* provided by the Reichhold organization."

Perhaps the several advantages of EPOTUF Epoxy Resins–their toughness, superior bonding, non-running after application – can help on one or more of *your* applications. Add to this two further "plusses"–expert technical assistance and fast delivery anywhere in the country – and you have ample reason for doing business with RCI.

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FOURTH OF A SERIES

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO. VYGEN

THE GENERAL TIRE & RUBBER COMPANY
CHEMICAL DIVISION • AKRON, OHIO

INTER-OFFICE MEMORANDUM

FROM: Production Superintendent

TO: General Sales Manager

SUBJECT: NEW RAW MATERIALS - VYGEN PVC RESINS FROM GENERAL TIRE & RUBBER COMPANY, CHEMICAL DIVISION

A group of specialized PVC Resins has been run through the lab and through production, with results so good that we thought you should have the details. All four are extremely high quality resins, filling definite needs in our production program, and eliminating many product difficulties which you and I have discussed at length in the past. The following points should aid your sales efforts.

For instance, you can start bringing in orders for light-colored injection molded parts. VYGEN 105 has the necessary heat stability to enable us to run these parts without the previous difficulties, and at the same price. We can also use this resin to produce a very high gloss extrusion, such as the one you proposed last month for one of your big customers.

VYGEN 110 has eliminated the color-drift problem we were having on calendered pastel goods. With this resin we have been able to maintain all shades very well through eight-hour runs.

With VYGEN 120 we are now able to extrude stock 128 from a dry blend. By thus eliminating the pelletizing operation we can make this product very competitive. We have also run stock 823, which has shown excellent electrical properties. This might allow you to develop some new business to keep our line going while established products are in "off seasons".

You might also be interested in the new method we are using to add colors. With VYGEN 161 we make a pigment-plasticizer-resin masterbatch, a much neater, more accurate and economical system. The very high plasticizer absorption of Vygen 161 makes it possible for us now to handle jobs that require large amounts of plasticizers.

Another important point for you to know is that we can get overnight delivery on any of these resins, so rush orders need no longer present such a problem, from the raw material standpoint. The service is excellent and the products are top-quality.

A B Ettengtre

Production Superintendent

quality flows much faster

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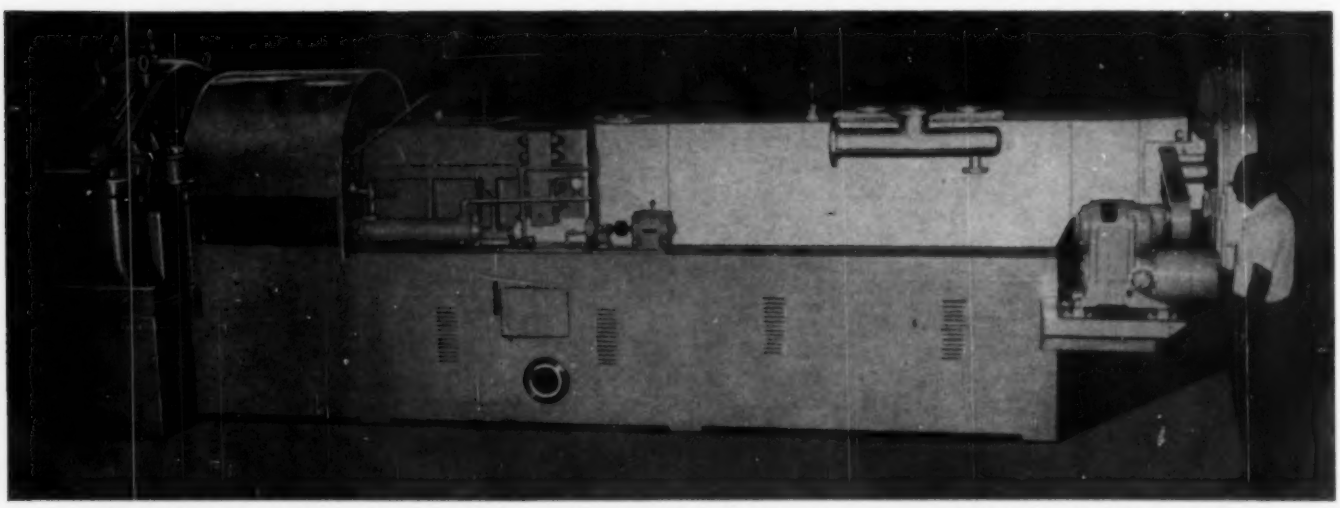

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PLASTICS TECHNOLOGY

Advances in Continuous Vacuum-Forming Processes

The importance of equipment, trimming or blanking operations, and design factors, including plastic temperature, thermoplastic material, and plug size, shape, and insertion speed is analyzed and discussed.

M. J. KALAHAR,
Kal Plastics, Inc.
Beaverton, Mich.

THE process of continuous vacuum forming of hot, freshly-extruded, thermoplastic sheet has advanced slowly since being introduced in 1951. In recent months, however, significant advances have been made in this field due to increasing interest in low-cost, mass production of disposable plastic packages.

One of the primary causes for this progress has been the development of vacuum-forming machines capable of functioning automatically at very fast cycles, and utilizing multiple-cavity molds. Machines of this type, combined with high-speed trimming devices, make possible a complete and economical in-line type of automatic sheet extrusion, vacuum forming, and trimming operation.

The major plastic suppliers are realizing the great potential of this process, and are developing special

Miles J. Kalahar was born in Frederick, Mich., in 1914. After graduating from Midland High School in 1933, he joined Dow Chemical Co. where he served in the development of shape and sheet extrusion in the Cellulose Products Div. from 1934-1948, and from 1949-1954 as an engineer in the Extrusion Section of the firm's Plastics Technical Service. He organized Kal Plastics, Inc., in 1955, and has been owner and general manager of the company to date. He also is a technical sales representative for Brown Machine Co., which has been active in the development of continuous extrusion and vacuum forming processes being performed at Kal Plastics., as well as in thermoplastic sheet manufacturing operations. Mr. Kalahar is a member of SPE, and also is active in the Lions Club of Beaverton, Mich. Mr. & Mrs. Kalahar have three children, and reside in Beaverton.

Based on a paper presented at the National Technical Conference, Society of Plastics Engineers, Inc., Detroit, Mich., Jan. 31, 1958.

Fig. 1. Original Dow continuous forming operation.

formulations of all types of thermoplastics for use in this field. The keynotes for successful merchandising of items manufactured by this process lie in the proper design of the part, and the correct selection of the plastic to be used for each specific application.

Continuous Forming Machines

The first successful results in the continuous vacuum-forming field were achieved at Dow in 1951. The primary objective was to create new, large-volume applications for their thermoplastic materials. Dow extended invitations to representatives from all branches of the plastics industry to observe the process (see Figure 1). At that time, only a few companies were able to visualize the huge potential market for disposable, plastic items mass-produced by this method.

The first company to design and build equipment for an automatic continuous-forming operation was Federal Tool Corp., of Chicago, whose applications included disposable ice cream and picnic dishes and other houseware items.

During this same period, Nalle Plastics, Millington Manufacturing Company, and Van Brode Milling Company developed their own methods for continuously forming hot, freshly-extruded sheet. Each of these companies designed and built its own equipment because of the complete absence of a capable machine on the market.

In 1953, Northern Plastics Processing Company ventured into the continuous forming of refrigerator components, using equipment built by Brown Machine Company. A short time later, Brown supplied equipment to Robinson Manufacturing Company, who became the largest producer of continuously-formed refrigerator inner door liners.

The early machines were very simple in their basic construction. The sheet was fed directly from the extruder on a continuous canvas belt. This belt conveyed the hot sheet under an air-operated, electrically-controlled mold carriage. The carriage was timed to cycle at the same linear speed as the sheet in a reciprocating motion, lifting the mold at the end of each forming cycle and returning toward the extruder for the next cycle. Later machines utilized small diameter, temperature-controlled, driven rollers, that replaced the canvas belt as a means of conveying the sheet.

This method of vacuum forming was quite satisfactory for the smoothly-contoured, shallow refrigerator doors being produced at that time. However, as the major refrigerator companies introduced the trend toward complex door liners with formed-in shelves, butter conditioners, and egg trays, this type of equipment was rendered almost obsolete.

By 1954, successful methods had been developed to form high-impact polystyrene into deep, sharp contours. Drape-forming and the use of mechanical assists made it possible to maintain better uniformity of wall thickness while drawing severe contours in re-heated sheet. This led to the logical assumption that the same techniques could be applied successfully to the continuous extrusion-forming process. Since thermal conditions tend to be more constant in the continuous process, it was obvious that equipment could be built to utilize these techniques to their best advantage on a continuous basis.

The continuous mechanical assist vacuum-forming machine (see Figure 2) was introduced to achieve the desired results. The basic objective was to develop a high speed process for fabricating thermoplastic items from multiple cavity molds on an economical basis. The greatest market potential existed in the disposable container and packaging industry.

The initial results obtained by the continuous process were very encouraging. Although mechanical failures were not uncommon, the basic theory was proved to be sound and practical. From an experimental nine-cavity, water-cooled aluminum mold with soft wood plugs, 65-70 one-pint round containers were fabricated per minute. From an initial sheet thickness of 0.020 inch, the finished wall thickness varied from 0.013-0.015 inch on the sides, bottom, and corners, to 0.018 inch on the lip. Results were equally favorable on a variety of thermoplastics, including high-impact polystyrene, cellulose acetate butyrate, oriented polystyrene, and both high- and low-pressure polyethylene. Needless to say, the different materials required variations in techniques and conditions.

The next experience in continuous mechanical assist vacuum forming involved a 48-cavity flower pit mold (see Figure 3). The part was rectangular in shape, 2½

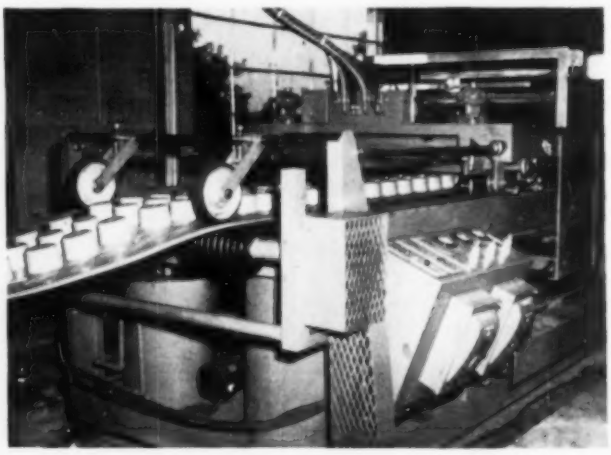


Fig. 2. Continuous mechanical assist vacuum-forming machine.

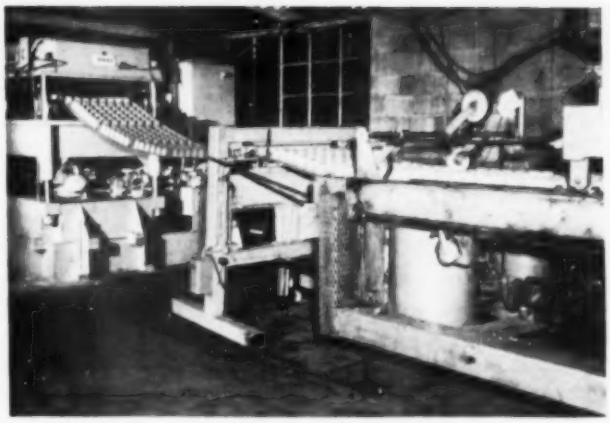


Fig. 3. Continuous extrusion vacuum-forming and trimming operation for 48-cavity plastic flower pot production.

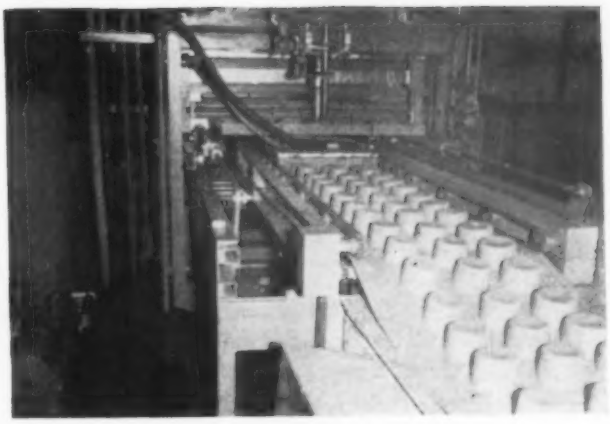


Fig. 4. Brown's new-design continuous forming unit.

inches square, and 2⅜ inches deep. This part presented entirely different fabricating problems. In order to obtain uniform wall thicknesses over the entire mold area, it was necessary to use a relatively heavy gauge sheet (up to 0.045-inch). The trim ratio of the rectangular parts formed from heavy sheet, however, was better than the trim ratio of the cylindrical parts formed from thin sheet (0.020 inch). The flower pot ratio is 60% usable parts to 40% trim, while the corresponding cylindrical pint container ratio is 50%:50%. The yield of the rectangular flower pot is 288 parts per minute when operating on a 10-second cycle.

The Brown Machine Company has recently designed and built a continuous forming unit (see Figure 4) that is much more compact and versatile than previous models. In this machine, the plugs or mold may be located either above or below the sheet line, as the situation dictates. This permits forming the parts with projections either above or below the sheet line. When forming parts from relatively heavy-gauge sheet stock, it is frequently necessary to mount the mold below the sheet line to compensate for sag in the sheet. The machine also is designed to utilize hot, freshly-extruded sheet or pre-extruded roll stock (see Figure 5) which is re-heated and formed at rates up to 24 linear feet per minute.

Trimming or Blanking

The most controversial and least-developed phase of the entire continuous-forming process is the trimming or blanking operation. It has been approached from several different angles with various degrees of success. Clicker dies, high dies, and steel rule-type dies have been used, both heated and unheated, against the forming mold and as a secondary operation. The heated types are capable of smooth, uniform cuts if a constant temperature can be maintained over the entire cutting area. However, the time required for the heat to penetrate the plastic generally is prohibitive. Rule dies generally are inexpensive, and present an economical method of trimming relatively small production runs (usually less than 10,000 pieces).

Our approach has been to trim with shear type dies mounted in an independent press aligned with the extruder and forming machine. Both mechanical and hydraulic presses have been considered. The mechanical presses have the advantages of high-speed operation, low maintenance cost, and longevity. However, the high initial cost, the floor space required because of the bulky press size, and lack of stroke control are definite disadvantages for these machines.

Because it was available in a small size, at a lower price, and offered over-all flexibility, we purchased a Dake hydraulic press with a 75-ton capacity. The press is up-acting with an area of 42 x 42 inches between posts. The upper platen has a 36 x 36 inches cut-out area to permit trimmed parts to telescope continuously and stack above the trim die. This facilitates removal of the parts, already stacked, from the top of the press. The press is capable of completing a six inch stroke in an over-all cycle time of three seconds.

The continuous web of formed parts is fed into the press, and the finished parts are blanked out. The plastic skeleton, or salvage web, then is fed directly through the press and into a scrap grinder. The reground material then may be conveyed by air, through a metal tube, and back to the extruder hopper.

Other Design Factors

Another important consideration relative to successful continuous forming is the design of the mold and plugs. Cast aluminum molds and plugs generally are considered necessary for high-volume production applications. The correct size, quantity, and location of vacuum holes is very important, and often are depend-

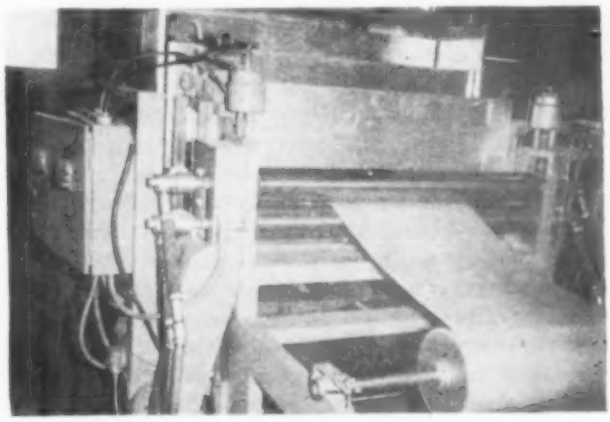


Fig. 5. Brown's new-design continuous forming unit showing roll feed of pre-extruded thermoplastic sheet.

ent on the type of thermoplastic being fabricated.

Other important design factors affecting the success of the operation are:

(1). Size and shape of plug, as related to the size of mold cavity and the type of material being formed.

(2). Plastic sheet temperature in relation to mold and plug temperatures.

(3). Speed of plug insertion, and its effect on uniformity of part thickness.

(4). Optimum distances must be maintained between parts to facilitate forming and trimming.

(5). Adequate plastic temperature must be maintained in the formed sheet to obtain a smooth, clean trim edge with a minimum of trim pressure required.

(6). Each of the different types of thermoplastic materials will present different forming characteristics and require some variations in fabricating technique.

Before entering into a continuous vacuum forming operation, serious consideration should be given to all aspects of the intended applications. The volume of the potential market is extremely important due to the high initial cost of equipment.

The following equipment price list is representative of the costs involved in establishing a complete continuous forming operation.

Forming From Pre-Extruded Roll Stock

Continuous forming machine	$15,000.00	
Plug temp. (heaters & instruments)	300.00	
Temperature control units (for vacuum mold)	750.00	
Vacuum pump (60-CFM., 5-Hp.)	800.00	
Air Compressor, (10-Hp.)	800.00	
75-ton hydraulic trim press	12,000.00	
Grinder for trim & scrap	4,000.00	
Total		$33,650.00
Tooling Costs for disposable hot drink cup (8-oz. capacity)		
36-Cavity water-cooled forming mold	$3,600.00	
36-Cavity trim die	4,500.00	
Total		$8,100.00

Extrusion Equipment Costs

4½-inch extruder and drive	$18,000.00	
Hopper loader-dryer, complete	2,400.00	
36-inch sheeting die	2,700.00	
Polishing & sizing rolls	5,000.00	
Roll-temperature controls (three units)	2,100.00	
Miscellaneous	550.00	
Total		$30,750.00
Total costs for extrusion continuous forming equipment		$72,500.00

(Freight and installation costs not included).

Conclusions

The field of continuous vacuum forming has steadily matured since its relatively crude conception. Equipment now is available to vacuum-form hot, freshly-extruded thermoplastic sheet or pre-extruded roll stock continuously. The auxiliary equipment capable of trimming parts formed by these methods has been developed to the point that the operation can be considered automatic. Granulators can be installed directly in line with the trim press to consume the salvage material as it is generated. The combined result is a completely automatic, in-line operation capable of manufacturing many parts that were previously considered economically impossible.

The plastics material manufacturers, anticipating the enormous potential of this process, are developing special material formulations adapted to the new techniques.

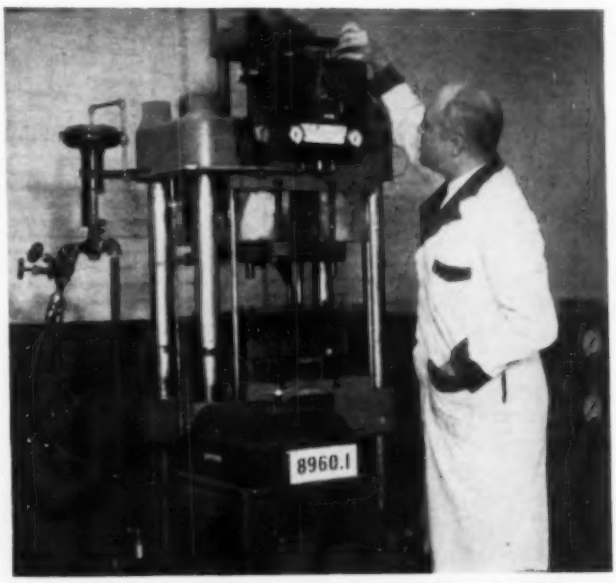
Quality control of the extruded thermoplastic sheet is a determining factor in the cost of continuously formed products. Well-plasticized sheet of uniform thickness (within ±0.001 inch) is essential for close cost control when fabricating parts by this process.

It has been found that appropriate design can affect directly the sales-appeal of vacuum formed parts. In thin-wall items, especially in the disposable category, ribbing is utilized to provide mechanical strength. This type of reinforcing frequently can be done to provide a pleasing decorative effect. —THE END

Mold Temperature Control Method

While installing their thermostatic equipment at Bell & Howell Co., Powers Regulator engineers discovered that mold temperatures could be controlled within ±3° by placing the thermal bulb outside the mold half. This was in direct contradiction to previously-established practices of putting it on the inside or in the steam return line. Resting on the upper mold half, the bulb transmitted relative mold temperature changes to the regulator through its capillary tube.

Room temperature does not have to be controlled; however, air steams from fans or the cleaning hose should not cross the bulb. Powers' Series 100 controller balances compressed air against the pressure sent it by the bulb. Of course, this method gives a relative reading only and, at the outset, a surface pyrometer is needed to get the actual mold temperature. The main advantage of the system is its obviating the need for boring holes into the mold. In small molds, this could be impossible.



New method of controlling temperature outside the mold.

K. J. GOOCH, *Lubr. Engr. and Asst. Division Engr. and*
W. C. WHITTUM, *Chief Engr.,*
Farrel-Birmingham Co., Inc.
Ansonia, Conn.

Roll-Neck Bearing Lubrication for Rubber and Plastics Calenders

Results of tests reported can serve as the basis for design and operating factors needed for reliable operation of the calenders under current conditions

PRIOR to about 1940, rubber and similar materials were processed in mills and calenders at moderate temperatures up to 200-250° F. Journal bearings were lubricated by grease, oil-soaked wicks, intermittent oil force-feeders, and, in a few cases, by a flood oil-circulating system. Bearing liners were bronze or babbitt, and roller bearings were used in a few cases.

Processing of plastics on mills and calenders expanded rapidly after 1945, with roll temperatures increasing to 300° F., 350° F., and, more recently, to 400° F. and higher. Calender speeds rose from 40 yards per minute to 100 and even 150 YPM. Added to these unfavorable conditions were the high bearing pressures created in calendering films of 0.004, 0.003, and even down to 0.0017 inch gage.

Looking backwards today, there is no wonder that bearings suitable for rubber processing were found incapable of sustained reliable operation when processing plastics. Of course, conditions were improved by certain empirical changes that were obviously in the right direction. Higher-viscosity oils quickly were found to give greater bearing capacity at elevated temperatures, but these heavier oils caused attendant problems of oil sealing and drainage, cooling, filtering, and pumping. Other obvious changes at that time were the abandonment of wick- and force-feed lubricators in favor of oil circulation or flood lubrication in order to keep the surfaces of journals as cool as possible. During the period from 1945 to 1955, those improvements made by mill and calender manufacturers were largely empirical in nature, and were made on a trial-and-error basis as new machines followed one another.

Bearing Test Machine

In 1954, our company's Engineering Department initiated the design and manufacture of a full-size bearing-testing machine. The purpose of this paper is to describe this testing machine and to report results which have been obtained thus far in the field of heavily-loaded, high-temperature journal bearings commonly used in plastics processing.

The need for such a machine had been recognized in the early 1950's, when it was found repeatedly that little finite data was available for large, slow-speed, heavily-loaded bearings operating at 300-450° F. journal temperatures. When the building of a test machine was decided upon, a further significant step was taken in selecting a journal size of 14 inches in diameter. The cost obviously would be higher, but it was felt that results would be more adaptable than those obtained from

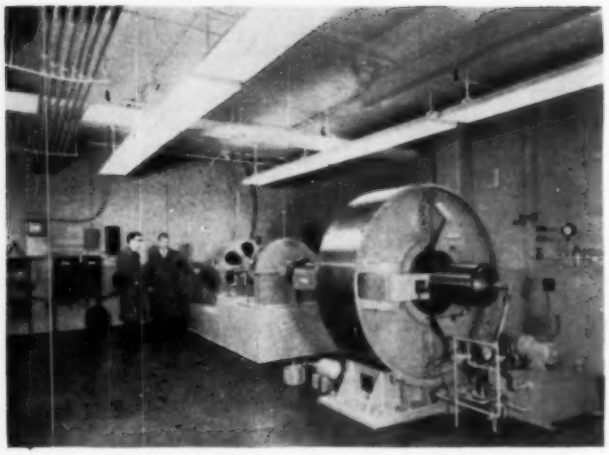


Fig. 1. Bearing test machine with bearing box removed.

previously known test machines, some having journals only 1-4 inches in diameter.

The need for a full-scale bearing tester was obvious when so many questions remained unanswered in the minds of alert designers and plant engineers. For example:

(1). What clearance between journal and bearing liners was best?
(2). How fine a finish was necessary on journal liner bore, and how does capacity vary with surface finish?
(3). What bearing materials would give greatest load-carrying capacity?
(4). What viscosity lubricants were required to minimize bearing wear?
(5). What added benefit came from additives in lubricating oils?
(6). How hot was the bearing liner for a given journal temperature?
(7). How much change occurred in liner clearances between cold and hot conditions?
(8). How hot was the oil film in the pressure area?
(9). Should bearing boxes be water-cooled or not?
(10). What was the effect, if any, of dirt or other contaminants in the lubricating oil? Is oil filtering important?
(11). What was the safe load-carrying capacity of a given bearing at various speeds, or when using different oil viscosities or different liner materials?
(12). What was the coefficient of friction under these same varying conditions?
(13). What about so-called synthetic oils in comparison with petroleum-base oils for obtaining higher bearing capacity in the 400-500° F. range?

Specific answers to these questions were not available, and the potential value to bearing users and to improved designs, in general, was ample justification for an extensive bearing research project.

Figure 1 shows a general view of the bearing test machine with bearing box removed, exposing the 14-inch diameter test journal. This journal is an iron or steel sleeve mounted on a tapered forged-steel shaft that, in turn, is mounted on roller bearings. The large circular ring permits application of pressure to the test bearing from the side, top, or bottom, as would be the case in a four-roll calender.

Figure 2 is a similar view showing a bearing box mounted in place. Figure 3 is a rear view showing D.C. motor drive and torque shaft, also instruments for recording pressures, torque, and temperatures.

The test bearing liners are 14 inches in inside diameter, 13¾ inches long, and are mounted in the same box used on a 22- x 60-inch plastics two-roll mill. The bearing is arranged for flood, force-feed, or grease lubrication, with volume and temperature control. Thermocouples were fitted into several points in the pressure area of the liner. Provision was made for loading the box against the journal up to a maximum of 300,000 pounds, using a hydraulic cylinder pressure source and an SR-4 strain gauge to measure the load accurately. A variable-voltage, D.C. drive motor was used to produce journal speeds from 0-20 RPM.

Heating of the journal up to a maximum of 500° F. was provided through a circulating hot-oil system. An electrical circuit was arranged to indicate metal contact whenever it occurred through breakdown of the oil film between the liner and the journal. Also, a torsion bar SR-4 gauge-load cell coupling was used to measure torque transmitted to the journal. A Brush recorder was used to obtain a continuous reading of these electrical measurements.

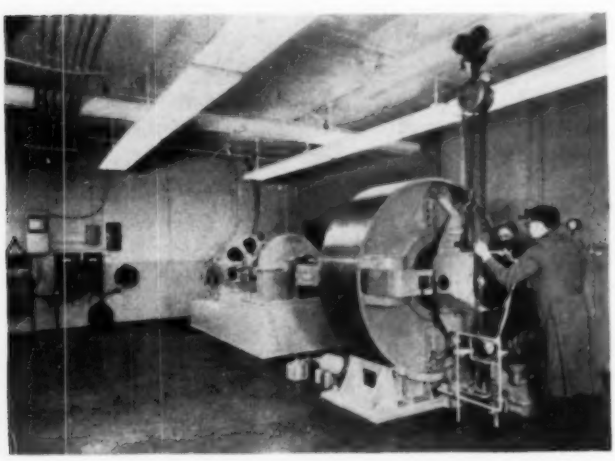


Fig. 2. Bearing test machine with bearing box.

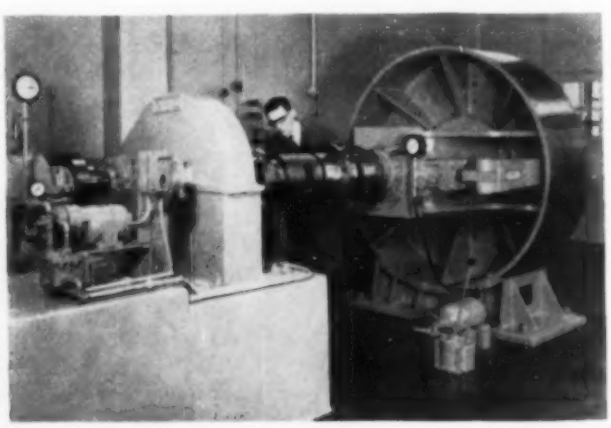


Fig. 3. Rear view of bearing test machine, showing motor drive, torque shaft, and instruments for recording pressures, torques, and temperatures.

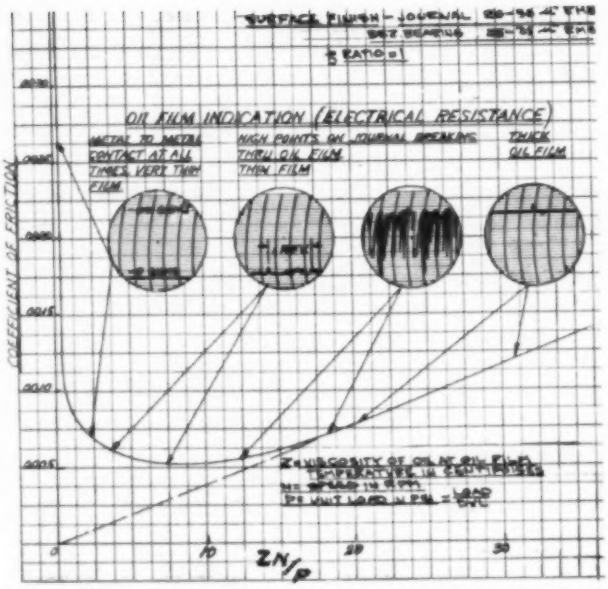

OIL FILM INDICATION (ELECTRICAL RESISTANCE)
METAL TO METAL CONTACT AT ALL TIMES, VERY THIN FILM
HIGH POINTS ON JOURNAL BREAKING THRU OIL FILM, THIN FILM
THICK OIL FILM
COEFFICIENT OF FRICTION
ZN/P

Fig. 4. Effect of coefficient of friction on lubrication term ZN/P for standard F-B bronze bearings. Insets show oil film indications (electrical resistances) at various points on curve.

Bearing Test Results

Over the past three years, a considerable number of tests have been run. Bearing liners of several different materials have been used, including SAE-64 bronze, aluminum bronze, babbitt, and aluminum alloy. Tests have been made to measure the relative bearing capacities of these several liner materials; the effects of different oil viscosities; the effects of different liner clearances; the effect of surface finish on capacity; the effect of dirt in oil; and the effect of speed.

In analyzing the mass of recorded data obtained from running several hundred tests, one of the most helpful means is that shown in Figure 4. In this and many similar charts, the coefficient of friction is plotted against the term ZN/P, which is commonly used in lubrication studies. The coefficient of friction was determined from measured torque load required to drive the journal under a given loading. "Z" is the viscosity of the oil in centipoises at the actual film temperature; "P" is the unit projected pressure in psi.; and "N" is the speed in RPM.

In the particular tests charted in Figure 4, it can be seen that a full oil film prevented electrical contact between journal and liner when ZN/P exceeded approximately 20. Between 10 and 20, the oscillograph showed intermittent metallic contact through the film, while below ZN/P = 8, there was almost continuous metallic break-through of the oil film.

A second most valuable comparison and reference method was found for correlating different tests. As pressure and temperature were increased, or as speed and viscosity were decreased, it was found that metal-to-metal contact occurred between journal and liner to the point where a substantial vibration was set up in the whole machine; a vibration which showed readily on the torque-measuring instruments. This point of vibration could be duplicated readily for given conditions, and was adopted as that point in operation of the bearing at which metal-to-metal contact would lead to progressive failure of the bearing through breakdown of the oil film.

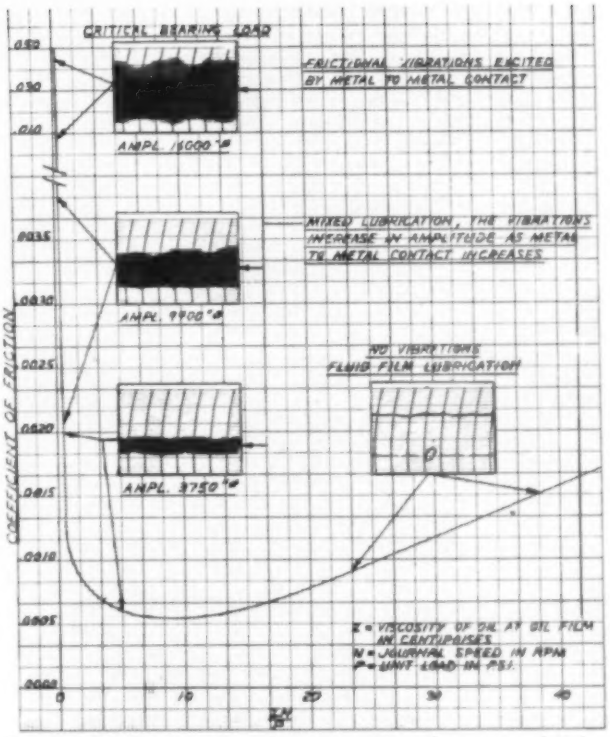

CRITICAL BEARING LOAD
FRICTIONAL VIBRATIONS EXCITED BY METAL TO METAL CONTACT
AMPL. 15000 "@
MIXED LUBRICATION, THE VIBRATIONS INCREASE IN AMPLITUDE AS METAL TO METAL CONTACT INCREASES
AMPL. 9900 "@
NO VIBRATIONS FLUID FILM LUBRICATION
AMPL. 3750 "@
COEFFICIENT OF FRICTION
Z = VISCOSITY OF OIL AT OIL FILM IN CENTIPOISES
N = JOURNAL SPEED IN RPM
P = UNIT LOAD IN PSI
ZN/P

Fig. 5. Stick-slip vibration phenomena (insets), as recorded by torque-measuring oscillograph, on curve of ZN/P versus coefficient of friction.

Figure 5 shows clearly this stick slip vibration phenomenon as recorded on the torque-measuring oscillograph. At ZN/P of 20 and more, little or no vibration occurred; at about 5, the vibration was very evident; and at about ½-1, it became intolerable. This point of maximum vibration amplitude became an excellent reference point when a series of tests were run to determine the effects of temperature, viscosity, clearances, finish, and dirt contamination. The load causing this extreme vibration or stick-slip operation of the bearing is hereafter called the critical load for a particular set of operating conditions.

Figure 6 follows the same charting form and, in this

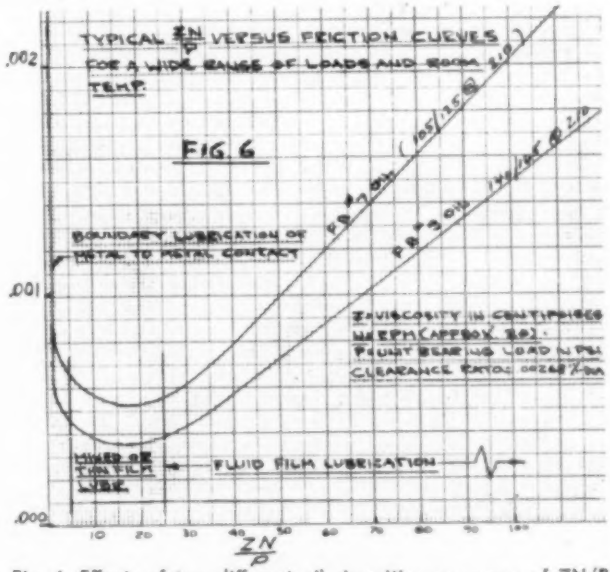


Fig. 6. Effects of two different oil viscosities on curves of ZN/P versus coefficient of friction over a range of calender roll-neck bearing loads at room temperature.

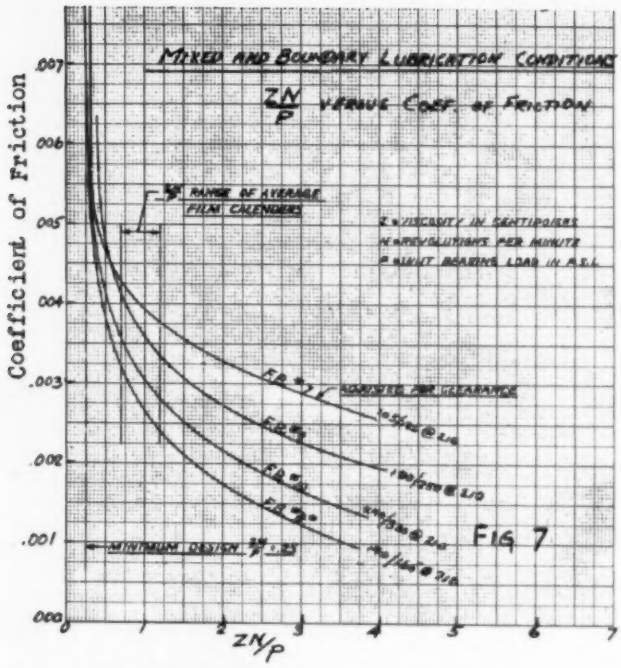


Fig. 7. Mixed and boundary lubrication conditions for four oils shown in curves of ZN/P vs. coefficients of friction.

particular case, shows the effect of using two different oil viscosities with all other conditions being held the same. Figure 7 is a similar chart using four different oils, and charting especially that loading condition in which most film calenders operate; namely, ZN/P = approximately one.

Figure 8 charts the stick-slip critical vibration point for three oils at varying pressures and temperatures. A

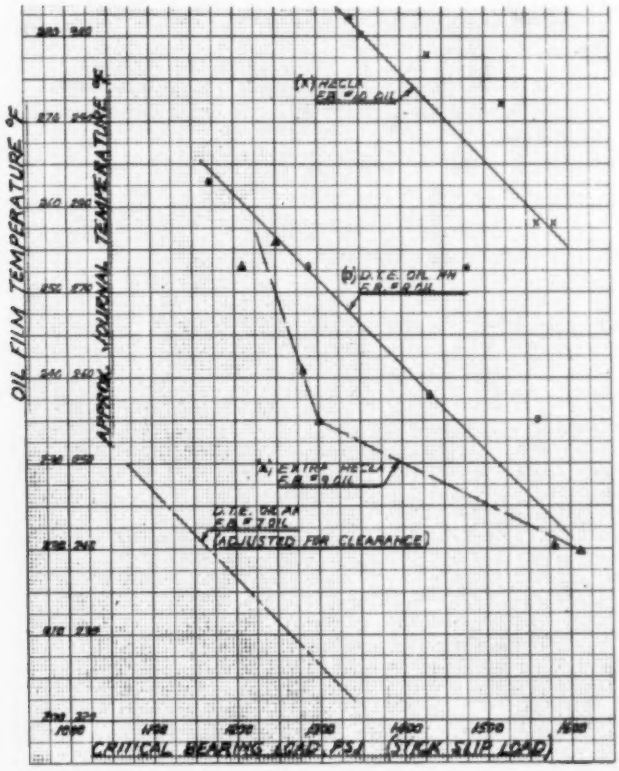

OIL FILM TEMPERATURE °F
APPROX. JOURNAL TEMPERATURE °F
(X) HECLA C.R. #10 OIL
(B) D.T.E. OIL AA C.R. #8 OIL
(A) EXTRA HECLA C.R. #9 OIL
D.T.E. OIL AA C.R. #7 OIL
(ADJUSTED FOR CLEARANCE)
CRITICAL BEARING LOAD P.S.I. (STICK SLIP LOAD)

Fig. 8. Stick-slip critical vibration points for three oils at varying bearing pressures and temperatures.

heavy #10 oil is shown to be necessary for operation at a 300° F. journal temperature; a fact learned from experience in the 1940's. For example, at 1,300 psi. journal load, undue vibration occurred with #7 oil when the journal temperature reached 225° F. With #8 oil, the critical journal temperature was 270° F.; and with #10 oil, not until the journal temperature reached 305° F.

Figure 9 shows a typical wear pattern on a liner after test, the dark lines being dye stains painted in the bore prior to the test in order to show wear location. Thermocouple leads may be seen at the left end of the liner. SAE-64 bronze showed a marked and repeated improvement in surface finish from an initial 30-40 RMS. to about 4-8 when run in; this condition, of course had been observed previously for years. A set of the tests showed measurably increased bearing capacity after this run-in surface was obtained; a confirmation of the importance of a careful run-in program for new calendar bearings; and a confirmation of the fact that bearing capacity is increased by finer journal or liner finish.

Figure 10 is important in its evaluation of the effect of a much-discussed factor in bearing design; namely, the amount of clearance between liner and journal. In this particular case, "B" is the better clearance ratio (0.0021-inch per inch of journal diameter) since it develops a lesser journal friction coefficient.

Figure 11 must be studied also before Figure 10 can be fully evaluated and utilized. Most discussions of clearances involve figures taken upon machining at room temperatures. In operation, however, the true clearance exists only after the journal, liner, and box have expanded under running temperatures. Many bearing troubles occurred 10-15 years ago when bearing clearances suitable for rubber processing were used without change at the higher temperatures necessary for plastic film calendering.

Figure 12 is especially important in this revelation of finite values of bearing capacity under varying conditions of journal finish. The stick-slip criterion was used here as a yardstick to determine the critical operating capacity of heavily-loaded calender bearings. Note, for example, that stick-slip occurs at ZN/P = 2 for 100-200 RMS. journal finish, whereas this same journal at 8 RMS. did operate down to ZN/P = approximately 0.1. Of interest, too, is data previously reported in 1955 by Rylander & Wight who, for different journal surface finishes, reported the point at which metal-to-metal contact first occurred between journal and liner. Acknowl-

Fig. 9. Typical wear pattern on a journal liner after bearing test.

edgment should also be made of tests made by United States Rubber Co. several years ago measuring load-carrying capacity at low values of ZN/P.

These tests on the effect of surface finish, and similar tests on the effect of dirt in the oil, on the degree of oil filtration, and on contamination particle size in the oil provide valuable aids to good bearing operation. Obviously, dirt in oil can score the liner and journal, and continued presence of dirt can cause progressive wear. A further detriment is the reduction in bearing capacity resulting from a rougher surface finish. This reduction can lead to overheating and failure of heavily-loaded bearings in a somewhat vicious cycle. Filtering of the oil to these bearings is highly recommended to help maintain good bearing surfaces.

Conclusions

Tests made thus far on bronzes, aluminum, and babbitt do not point to any one preferred material for all applications. Each material has certain advantages and disadvantages. Bronze, for example, has a higher bearing capacity than babbitt under ideal conditions, but is damaged more quickly by dirt and can score the journal sooner in the event of uncertain lubrication. The preferred bearing liner material, therefore, is dependent upon a number of factors, including loading, speed, temperature, hardness of journal, type of lubrication, and possible presence of dirt. For certain specific operating conditions, the bearing tests reported herein already have provided a sound basis for a bearing material selection. For different conditions, another material might be indicated.

As journal operating temperatures increase into the 400-500° F. range, oil viscosity becomes highly important. Synthetic oils having a higher viscosity than petroleum oils at these temperatures already have proved themselves in production applications. Their added bearing capacity was confirmed in tests made up to 500° F. journal temperature. A recently installed 32 x 92-inch inclined "Z" calender for 500° F. incorporated bearings that were built only after tests had been run to check oil suitability, liner design, journal clearance, and method of oil inlet.

In summary, it can be said that these tests can be the basis for design and operating factors essential to reliable operation under today's conditions. Further studies will be necessary as temperatures increase, and as improved lubricants and bearing materials become available. Comments or questions from suppliers of lubricants or bearing materials, from plant engineers, and from others interested in this general problem will be welcomed.

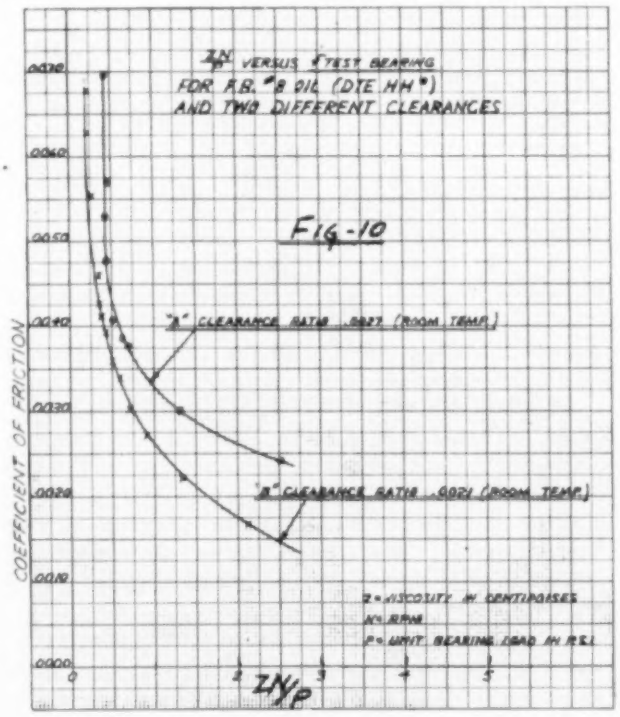


Fig. 10. Curves of ZN/P vs. coefficients of friction for test bearing using F-B #8 oil and two different clearances between liner and journal.

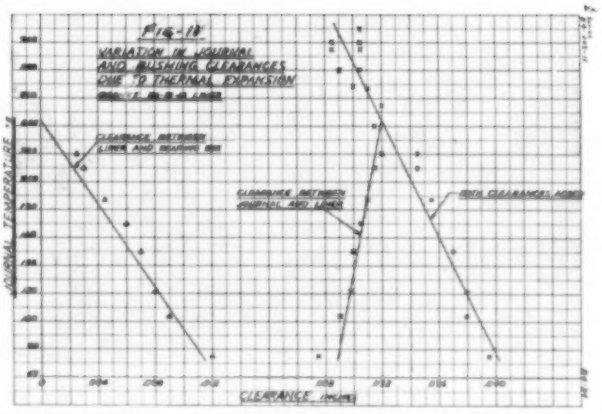


Fig. 11. Effect of journal temperature on clearance between journal and bushing.

Acknowledgments

The tests reported were made by Messrs. Baxter, Van Dissel, and Bienkowski, under the supervision of P. H. Dreissigacker, assistant chief engineer for Farrel-Birmingham.

—THE END

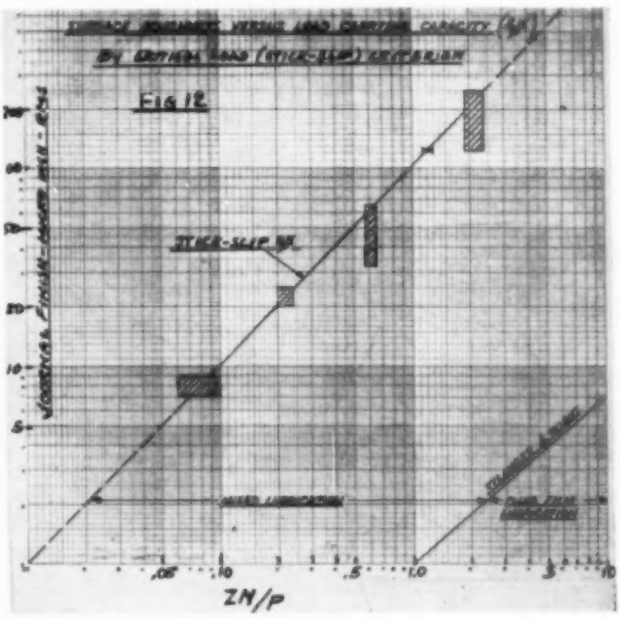


Fig. 12. Effect of journal finish on load-carrying capacity, ZN/P.

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Use of Radiation Gages in Plastics Extrusion

The source-detector units provide a simple read-out system that controls production, improves extrusion quality, and reduces costs of processing.

THIS discussion will be confined to the application of radiation gages in various plastics extrusion processes. These include flat film extrusion, polylamination extrusion, and blown film extrusion processes. The control required for the processing of bioriented films also will be mentioned. The results achieved by continuous measurement and automatic control of film thickness will be covered from both quality and economic standpoints. Current work that indicates the trend of future development will be mentioned, as will a brief description of data read-out.

Figure 1 shows a typical beta gage source-detector unit. These units actually measure weight per unit area of the specimen. However, when density of the material being measured is constant, they may be calibrated in thickness units.

The radioactive isotope is located in the lower head. The most common emitter is strontium-90, although for thin films the lower energy sources of thallium-204 or krypton-85 are used. The beta particles pass up through the plastic sheet; the thicker the sheet, the smaller the amount of radiation that will reach the ionization chamber located in the upper head. The minute signal produced by the chamber is used to provide indication on the strip chart recorder by means of the associated circuitry.

Figure 2 is a recorder chart showing typical ranges for thin films. This equipment is calibrated permanently in our manufacturing plant, using samples of the customer's products. When various ranges are set into the instrument, the range is selected by means of a multiposition switch. There are no other adjustments that will affect the readings. If an incorrect range is selected, the recorder pen will remain off-scale.

It is possible to modify the measured area as required by the specific application. This area may range in size down to a rectangle measuring $\frac{3}{16}$ by $\frac{3}{4}$ inches. More commonly, the area of measurement will be a circle having a diameter between 1-2 inches.

The measuring heads are moved continuously across

the sheet, and the trace that appears on the chart gives the operator a picture of the cross-sheet or profile variations. The individual profiles are fed to an analog computer that integrates the variations and gives the average thickness of the sheet. The controller then compares this value with the target thickness. If the average thickness is not on target, the appropriate control action is taken to adjust the sheet thickness produced by the sheet manufacturing operation.

The earliest application of radiation equipment to the plastics extrusion process occurred about five years ago on a sheet die laminating process (see Figure 3). The measurement problem posed to the operators of these laminating processes is more severe than that facing manufacturers of unsupported films. In the extruder-laminator process, it is impossible to measure either weight or thickness of the extruded material directly. In some cases, a chemical stripping approach is possible, although this method generally is impractical.

The use of beta gages does not overcome the need for an indirect measurement approach. Two measuring systems are required; the first unit measures the base material, and the second unit measures total weights of base sheet plus poly coating following the lamination. It is then necessary to subtract electronically the first measured weight from the second.

Another early application utilized a reflection-type S-D unit to measure a flat poly sheet. Figure 4 shows the thickness variations observed during the start-up.

The first application on blown film occurred on a process where the edges of the flattened tube were trimmed and the two halves of the sheet separated. Each half then is measured by its own gage, and both profiles are presented by means of a two-pen recorder as the thickness gages scan the sheet. As soon as the operator becomes familiar with this arrangement, the profile adjustments are straightforward. The automatic control in this case must operate from only half the sheet. A number of factors that introduce profile variations were uncovered by this installation.

Current Uses

Currently, a gage measuring the double thickness of a flattened blown tube controls the process very effectively. In this case, it is possible to rotate the tube slightly when making profile adjustments. A streak appearing on the recorder chart will move in one direction if it is in the bottom of the double-thickness tube, and in the opposite direction if in the top thickness.

There are numerous AccuRay units operating on both flat and blown bioriented films. A more complex control usually is required for these processes. We have utilized an analog computer to determine the optimum control system.

There are many different reasons for installing continuous thickness measurement equipment. The most obvious factor is that of quality. Many characteristics of the product depend directly on the film thickness. The maintenance of good uniformity across the sheet is a prime requisite in the production of quality film. Unfortunately, however, this is not easily done and continuous measurement greatly simplifies the job. Figures 5 and 6 show the improvement that can be obtained. A study of the results of many varied installa-

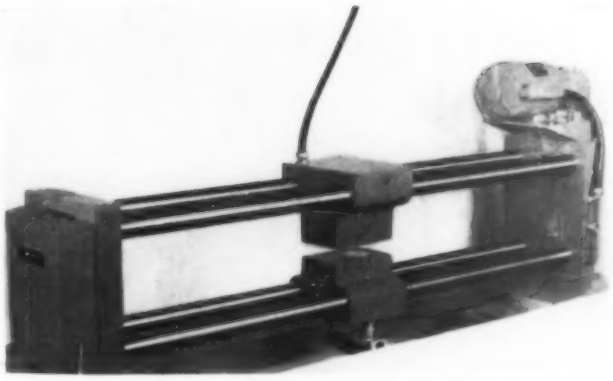

Fig. 1. Source-detector unit used for extrusion processes.

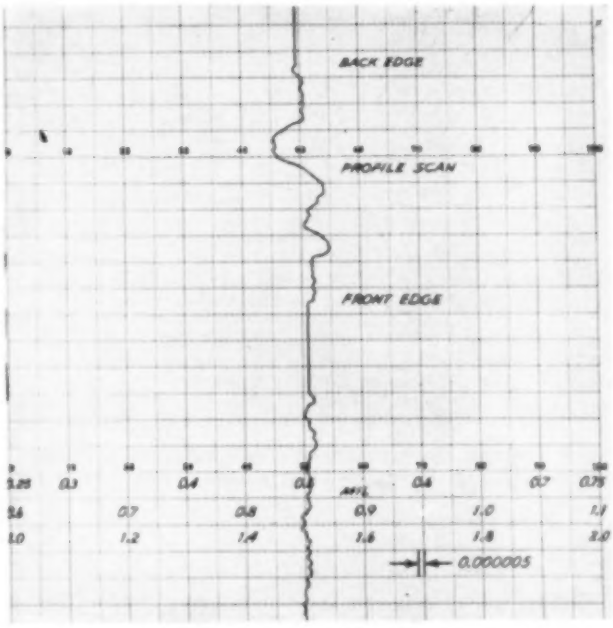

Fig. 2. Source-detector recorder chart showing typical ranges for thin film (cellophane) extrusion at 200 feet/minute. Chart speed is three feet/minute.

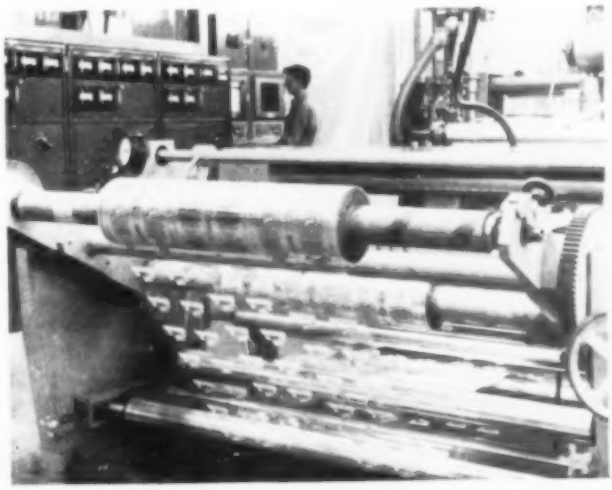

Fig. 3. Earliest application of radiation equipment in plastics extrusion was on a sheet die laminating process.

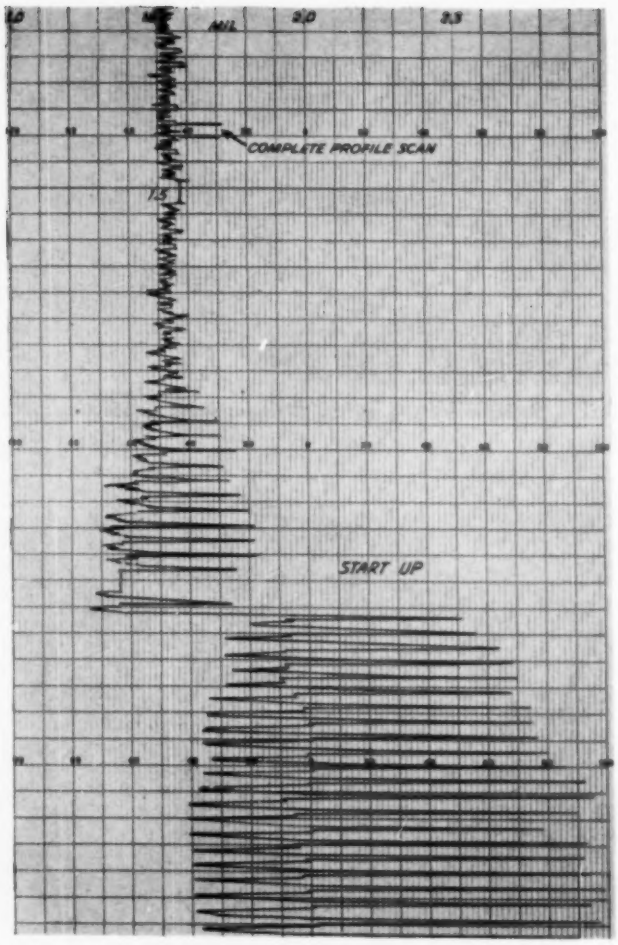

Fig. 4. Thickness variations observed by a reflection-type radiation gage during start-up of a flat sheet extrusion.

tions shows that an average improvement in profile of 45% can be obtained, while extreme cases show an improvement up to 70%.

A second result is that of scrap reduction. A polylaminator can expect an annual savings of between $20,000-30,000 because of faster start-ups. The savings figure is lower, but still appreciable, for other extrusion processes. In a trade journal article, one customer stated that "At the end of six months, it is calculated that the instrument had paid for itself in direct cost reduction. Set-up time cut in half . . ." In addition, we have heard of several cases where the increased uniformity has materially affected the sales situation. One additional customer can justify the cost of a beta gage.

The factor cited most often to justify this equipment is that of better control of yield. The reduction of machine-direction weight or thickness variations usually is described in terms of σ and material falling within $\pm 2\ \sigma$ includes 95.5% of the total. Figure 7 shows the results obtained from a long-term study where σ was reduced 43% and the yield increased 6.7%. Depending on the poundage of polymer processed, this would be reflected in an annual savings of from $10,000-30,000.

Occasionally, it is stated that snap gage accuracy is inadequate on thin films, but gives all the measurement needed on heavy-gage material (see Figure 8). This chart was obtained from a polystyrene extruder being controlled by conventional measurement. A portable unit measuring at only one point reveals startling variations in thickness. Yield improvement of 5% is reasonable with radiation measurement in this case.

Other benefits obtained by use of radiation gages are: (a). die development; (b). polymer analysis; (c). evaluation of operator and machine; (d). higher sleeper through-put up to 40%; (e). elimination of destructive sampling with longer rolls; and (f). continuous record of production.

Future Prospects

Some tools now are available that lend themselves to accurate analysis of machine performance. The first of these tools is the process quality computer. This

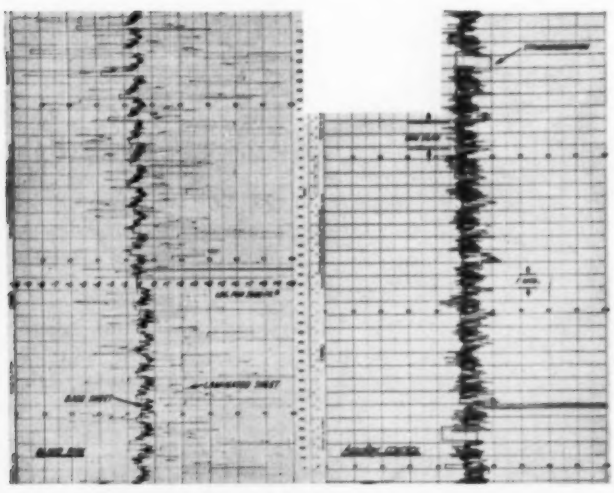

Fig. 5. Improvement (right) that can be obtained in controlling thickness of white, high-impact, extruded polystyrene at 300 pounds/hour. Original thickness (without source-detector control) is shown at left.

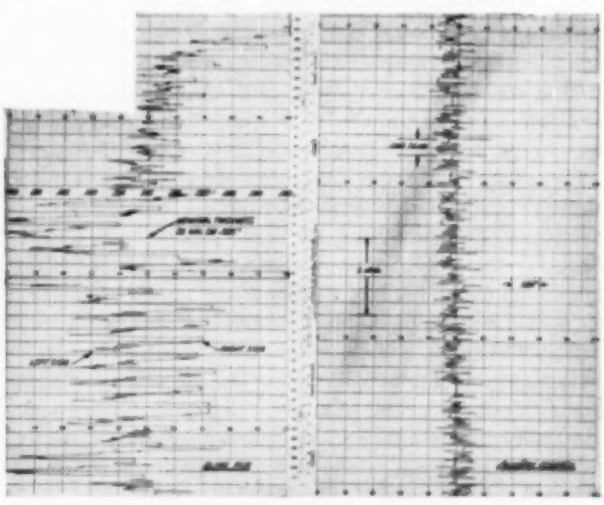

Fig. 6. Improvement (right) that can be obtained in controlling thickness of two-mil polyethylene extrusion for cellophane laminating. Blind run (without source-detector control) is at left.

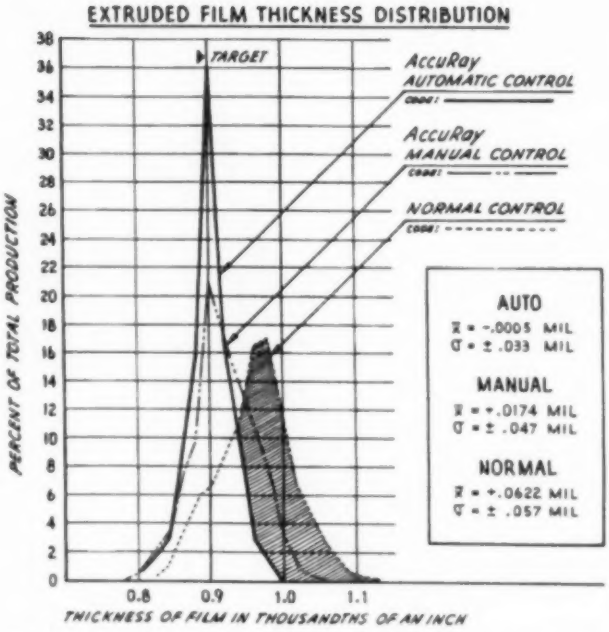

Fig. 7. Improvement in machine-direction thickness of extruded plastic film obtained by use of AccuRay source-detector control.

unit computes the process spread over a period of time, thus giving a quantitative answer to the questions, "How is my process running today?" Naturally, many factors will affect this reading; some of these are the material being extruded; the temperature control equipment; the type of screw; and last, but not least, the operator.

This computer will be used not only to monitor the operation of the extruder, but also, when used in conjunction with the frequency analyzer, permits a detailed

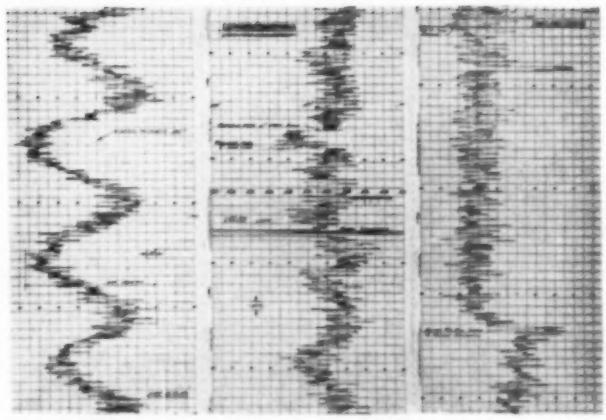

Fig. 8. Chart strips (left to right) obtained from a heavy-gage polystyrene extruder using conventional thickness control by means of single-point measurement.

analysis to be made. Each variable in the process has a characteristic frequency, and the computer can measure the magnitude of the variable. Thus, it is possible to establish definitely the cause of the variation. This means that even short-term variations can be reduced because any change in the process can be evaluated readily. It also means that the combination of all variables can be set to give optimum conditions. The effectiveness or need for this technique in reducing short-term variations depends on the percent of short-term variations present in the total variations of the product. Numerous studies of this type have been made in the past, but without the advantage of continuous measurement to evaluate the results.

Automation is continuing to advance, with each step revealing new marvels. It appears that the next phase

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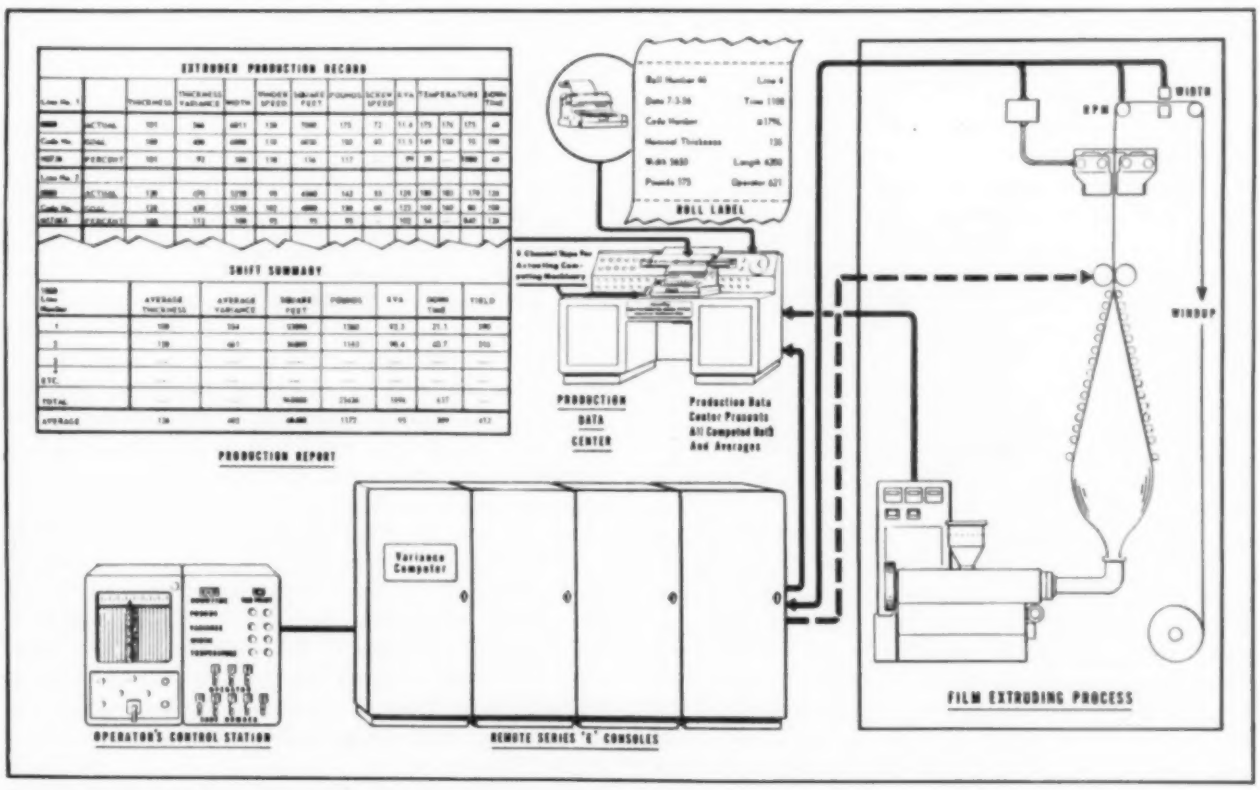

Fig. 9. Simple read-out system for control of film extrusion process.

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The Thirty Years of Plastics Impact Testing—Part II

The conclusion of a two-part analytical discussion of past accomplishments and the present status of impact testing, and the outlook for the future.

A monumental report on impact testing up to 1948 was presented by Lethersich (25). Unfortunately, this report has not been as widely known in this country as it should be. More than 200 references are included in this report. Lethersich stated that the most important contribution to the subject of impact strength up to the time of his writing (1948) was that presented in 1923 by Ludwik (26). Ludwik postulated that two distinct types of failure can occur in a material. If shear failure occurs, a tough fracture results. If cohesion between the molecules is broken, however, a brittle failure results.

Lethersich extended the work of Ludwik concerning notch effects and the type of failure. Ludwik had attributed brittle failure to pure tension, and tough failure to shear. Since tensile strain has a shear component, this concept had to be modified to replace the pure tension concept by uniform triaxial or hydrostatic tension which is free from all shear components. Uniform triaxial tension is associated with the molecular cohesive strength, and is limited to very small elastic-type deformations before a brittle-type failure is produced. All flow or time-dependent deformations are associated with shear. In a state of uniform triaxial tension, Lethersich pointed out, the way is opened to low impact values because of the absence of plastic flow. This state can be promoted by low temperatures, high impact velocities, or an increase in specimen width.

The same effect of increasing the triaxial tension can be produced by notching the specimen. The true purpose of notching, therefore, is to produce brittle-type failure at low velocities and room temperatures by reducing the plastic flow. A good review of specimen and notch sizes and shapes as well as a detailed explanation for the effect of the notch was presented.

Lethersich found the Charpy or keyhold-type notch to be the most easily reproducible. The scratches of the Charpy notch are produced by drilling, and are in a direction parallel to the direction of the tensile stress. These scratches do not affect the impact strength, while those scratches produced by milling a Vee-type notch run at right angles to the tensile stress and have an appreciable effect.

The ASTM specification for metals (27) recommends

that different types of notches be used to determine the most suitable one for any given material. This is usually taken to mean the notch having the greatest notch brittleness effect. Riegel and Vaughn (28) recommended that a sharp Vee notch be used for ductile materials; a round notch be used for tough materials; and no notch be used for brittle materials.

In contrast to this, ASTM Specification D256-47T governing impact testing of plastics and electrical insulating materials specied that a Vee-type notch of given dimensions and shape be used on all materials covered by this specification. At first glance, it would appear that this latter specification might have a more exacting scale of comparison. However, Lethersich pointed out that the effect of notching upon the impact strength depends upon Poisson's ratio and the degree of anisotropy of the material, as well as upon the shape and depth of the notch. The effect of notch would vary, therefore, from one material to another even though the notch is the same for each specimen.

Lethersich proposed that impact determinations be over a wide range of velocity, so that the velocity at which brittle failure occurs could be determined. Materials then could be compared by noting the critical velocity. According to Lethersich, the purpose of the impact test is to ascertain the conditions under which materials will show tough or brittle failure, so that the latter type of failure can be avoided in practice. It also was recommended that tensile impact tests be given more consideration because the broken-half error is easily eliminated in this type of test.

Quackenbos, Hill, and Staff (29) have advocated the replacement of the Izod test by: (a) the Charpy test on notched and unnotched specimens, or (b) the Charpy or flexural test, depending on the material, also on notched or unnotched specimens. The type of design applications would determine whether the notched or unnotched data should be referred to in the selection of a suitable molding material. The reason given for the abandonment of the Izod test was that the losses to that type of machine were excessive.

The impact resistance of several phenolic molding materials, as determined by the falling weight, increasing-blow method, were reported to be independent of the initial velocity in the range from 0-14 feet per second. However, the impact resistance was observed to increase when the available energy of the pendulum in a Charpy machine and the initial velocity were increased together. It was concluded, therefore, that the impact resistance varied only with the available pendulum energy.

Maxwell and Rahm (30) presented a new method of impact testing in which a standard Izod-type specimen is attached to the periphery of a flywheel that can provide a wide range of loading rates. An anvil can be made to obstruct the path of the free end of the specimen to produce the fracture, and the energy removed from the flywheel is determined. Since the specimen is in motion prior to the impact, it contains the kinetic energy necessary to throw itself after it hits the anvil. No energy is lost from the flywheel for the toss.

A certain amount of energy is dissipated in the plastic deformation or denting of the specimens at the points of loading. Some of this plastic impact energy in the Maxwell and Rahm method of test (30) is supplied by the flywheel, and some is supplied by the kinetic energy of the specimen. It was reported that the impact value obtained by this method includes the plastic impact energy supplied by the wheel, but not the plastic impact energy supplied by the specimen. In a discussion following this paper, Telfair discussed the merits of including the plastic impact energy as part of the impact value.

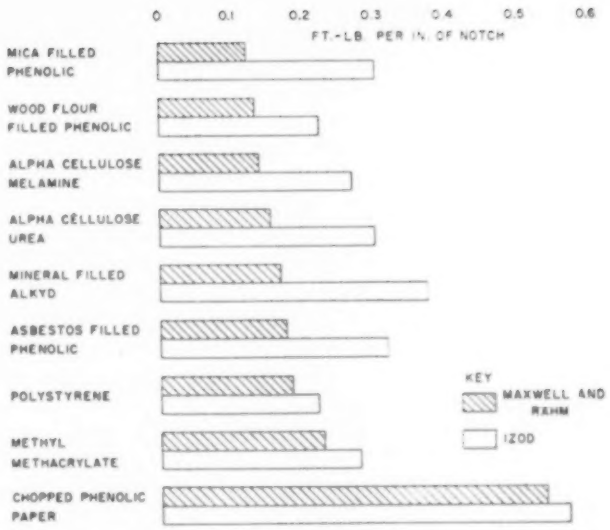

Fig. 6. Comparison of Izod impact strengths with results from the test method of Maxwell and Rahm (30).

Comparisons were made between the impact results obtained on this new machine and those obtained on the standard Izod machine at the same impact velocity for several molding materials (see Figure 6). It is shown that the toss factor for the high-density materials can cause the Izod impact results to be in error by more than a factor of two on the high side.

No noticeable change in impact strength with change in velocity was observed for notched samples in the range from 7-0 feet per second. Since notching the sample was known to accentuate the brittle response in the materials, it was proposed that the flywheel-type machine be modified to test tensile specimens. This was done, and will be mentioned later.

Adams (31) made a study of the sources of variability in impact results when using the ASTM standard Izod test method on styrene, cellulose acetate, and phenolic molding materials. The effect of vise-gripping pressure was significant for styrene only. All materials tested were sensitive to variations of notch radius and variations in depth of material under the notch. The larger the radius or the greater the depth under the notch, the greater was the apparent impact strength. A magnification of 55 diameters or more is recommended for the check on the notch radius.

Woodham, Wirick, and Markwood (32) developed a single-blow falling weight testing machine for determining the impact resistance of small quantities (as little as 20 grams) of material. In this method, a notched miniature plastic specimen is cantilevered from the end of a cantilevered steel beam. The free end of the specimen is struck by a falling weight at

a velocity of 11 feet per second so that correlation may be made between these results and those of the standard Izod test on the same materials. The maximum velocity of the end of the steel cantilever is measured electrically. The input energy was found to be proportional to the square of this velocity and, therefore, to the square of this electrical response. Confidence limits of 95% were reported for the correlation between the two test methods.

Since this miniature test method measures only the energy delivered to the clamped end of the specimen, the toss factor is eliminated. For comparison purposes, the Izod test results had to be corrected for toss by a modification of the methods of Zinzow (5) or Callendar (3). Instead of the replaced broken half being knocked away with the same pendulum velocity that broke the specimen, the pendulum is raised only to the height to which it rose after breaking the sample. While the correlation between the results from this machine and the Izod machine is good, the relationship still is an empirical one.

Woodham, Wirick, and Markwood (32) favored the complete fracture criterion for failure because the specimen failure based on the first perceptible crack in the material often was difficult to recognize. It should be remembered that when looking at the cross-section of a specimen, a crack is a two-dimensional manifestation rather than one-dimensional. When a crack has appeared, it must be recognized that some energy due to propagation has been expended.

Maxwell and Harrington (34) gave a description of their flywheel-type tensile impact tester. The tensile impact tester has the advantage that there is no broken-half error, since the broken half is held firmly by the fixed vise after impact. Experimental results were confined to methyl methacrylate in that paper. However, in a later paper by Maxwell, Harrington, and Minica (35), results from this machine were reported for nylon and phenolic, among other materials. Impact strengths for these materials were presented for impact velocities from 0.0001-300 inches per second. For the medium range of velocities, a special machine that records load versus deflection was used. For the very low rates of straining, a Baldwin universal testing machine was employed.

In most materials tested, there appeared two distinct and separate energy drops; one at a very low rate of loading, and the second at a much higher rate. The second or higher velocity energy drop is believed to be caused by the inability of the chains to uncoil at velocities over this second dropping point. Similarly, the first energy drop indicates that the chain slipping can occur only at velocities under the first critical velocity.

For nylon, the velocity spectrum was presented for five different temperatures from 30-90° C. The plots of impact strength versus velocity in Figure 7 each contain two maxima in place of the two energy drops usually observed. It can be noted from the plots that for all temperatures reported, the impact strength was higher at the higher velocity peak than at the low velocity peak. The appearance of two peaks in the impact strength versus velocity curve does not seem to have been predicted by any impact theory presented

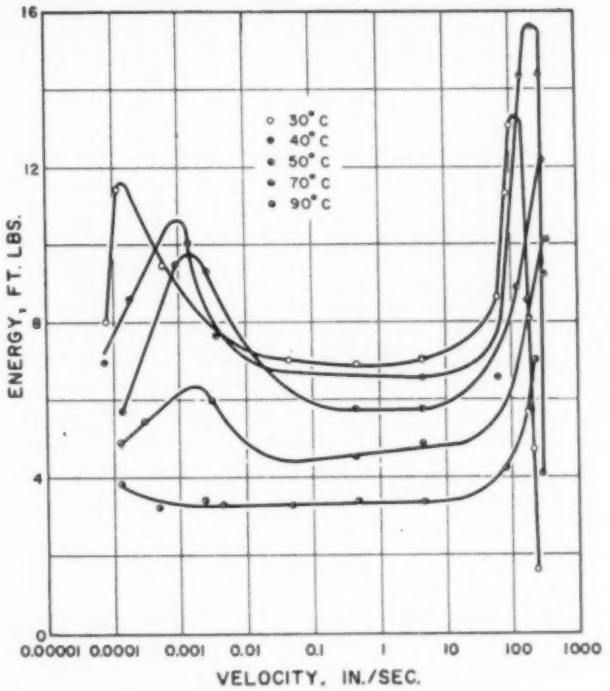

Fig. 7. Effect of impact velocity on the tensile impact strengths for nylon at several test temperatures (35).

so far, and has not been observed for any material other than nylon. There is the possibility that such a phenomenon may be characteristic of microcrystalline materials in general.

Only a slight increase in the impact strength of phenolic molding material is observed in the velocity range from 0.0001-1,000 inches per second. Since the moment of inertia of the flywheel can be varied easily, a study of the effect of flywheel capacity would be of interest since there has been considerable controversy over its effect upon the impact strength.

Through the use of this type of testing machine the effect of temperature, plasticizer, energy capacity, and velocity (rate of straining) on impact strength can be determined free from errors due to toss factor, notch sensitivity, notching irreproducibility, non-uniform rate of loading during fracture, and fatigue effects. Being able to eliminate these variables makes it possible to study the effect of each of these variables separately.

Robert Burns (36) has reported on the Dozi (Izod spelled backwards) impact testing machine which differs from the Izod tester in that the Dozi-type specimen is clamped in the pendulum to give results similar to the Maxwell and Rahm machine (30) in eliminating the toss factor. This equipment has the advantage of being nearly as handy to operate as the Izod tester, but can not be used readily at more than one velocity. A comparison of this Dozi machine with other instruments was made for a number of common plastics.

Adams, Jackson, and McCarthy (38) pointed out some of the shortcomings of present impact, tensile, and flexural tests in predicting the toughness of rubber-styrene blends and other plastic materials. The Izod impact results were shown to be greatly affected by notch radius and test temperature. Variations in mold-

ir.g conditions and the orientation due to molding were discussed, and the effect of orientation on drop-ball and Izod impact results were shown for several materials. The authors proposed an evaluation program for determining the toughness of anisotropic materials. Tensile property measurements at two widely separated loading rates were included with drop-ball and Izod impact tests at various testing and molding conditions on various test specimen sizes.

The interest in tensile impact testing that has developed in recent years in research and ASTM circles was further increased a year ago by a paper by C. G. Bragaw (39) in which he described a rather simple adaptation of the standard Izod tester. This modification consists basically of replacing the conventional Izod vise with one capable of holding the fixed end of a tensile specimen, and securing a metal cross-head to the other end of the specimen. The pendulum is reversed and, when allowed to swing, strikes the cross-head, tossing away both cross-head and a portion of the specimen. Small molded or machined tensile specimens are tested at 11 feet per second. Strain rate effects can be studied easily over a limited range by varying the effective length of the specimens tested at this one velocity.

The more obvious appealing features of this tester are overshadowed to some extent by one of the principle difficulties of the Izod tester itself—toss factor. In an effort to minimize the toss energy, a magnesium cross-head was employed. While the actual toss energy is reduced by the ratio of the densities of the cross-head materials compared, the elastic strain energy stored in the cross-head may increase by the same ratio. Plastic, as well as elastic, strain energy lost to the cross-head does not improve an already-difficult correction factor.

The fires of discontent with the impact situation have been fanned recently by C. E. Stephenson (40) with his appraisal of the Izod impact test. A study of the effect of clamping pressure on a specimen held in perfectly parallel vise jaws has shown that if the clamped sides of the specimen also are parallel, there is a linear decrease in impact strength with increasing clamping pressure leading to nearly 20% reduction over the range of pressures. However, a taper of 0.005-inch on the specimen was found to give errors up to 25% of the expected impact strength of a parallel specimen.

An investigation of the ever-present problem of notch preparation for both the A.S.T.M. and B.S. notched specimens has indicated that impact variations in excess of 10% can be expected because of notch cutter differences. The A.S.T.M. test, compared to that of the B.S., is reported to measure mainly crack propagation instead of crack initiation. Torsional stresses set up in the Izod specimen due to skewness between the pendulum anvil and the front surface of the specimen were reported to give increased impact strengths even for very small angles of skewness.

Outlook for the Future

In summarizing the impact testing of plastics, it is necessary to consider it both from the standpoint of a quality control instrument, and of an instrument for the investigation of the fundamental properties and behavior of plastic materials.

The Izod, Charpy, and several other impact machines have served fairly well as watch-dogs in the field of quality control. What these impact results mean, and how they might be correlated between machines, is of little concern for the control of some industrial processes. The prime requisite is that the reproducibility and standardization of notches, dimensions, conditioning, and machine calibration be maintained. There is room for considerable improvement in standardization and reproducibility in the Izod- and Charpy-type tests that are most widely used and accepted by the plastics and related industries.

The Charpy-type machine might be improved by redesigning the pendulum and fixed supports so that the broken halves do not hit the pendulum after the fracture. Part of the deviation of the results is believed to be due to the pendulum anvil not striking the Charpy specimen directly behind the notch. Since the line of impact is on the plane of failure, its accompanying plastic deformation and shock wave have considerable effect upon the fracture.

A four-point method of loading was used on steel Charpy-type specimens by Lavery and Southwell (37) in 1934 to overcome this difficulty. These authors found for steels that the average deviation from the average impact value could be reduced almost tenfold to 1.5%. An additional advantage to this method is that when the specimen is properly placed with the notch equidistant from the two center supports, there is a uniform bending moment without any shearing force along that central portion of the specimen.

A second type of impact test is required to determine the conditions necessary and energy required for a material to exhibit tough or brittle failure so that the service requirements of manufactured articles can be met. Most of the existing impact machines provide impact information at only one set of conditions or with too many variables involved to provide any information of a fundamental nature. Such information has been so eagerly awaited that too often broad conclusions have been arrived at from the fragmentary bits of information. Unfortunately, not enough data have been taken from those machines that are capable of revealing information of a fundamental nature. It is only through such thorough studies of the individual parameters that the impact picture can be brought into proper focus.

Mathematical analysis of the behavior of viscoelastic materials is so complex, particularly for flexure, that it will be some time before we shall have a theoretical solution to the impact problem. It would appear that the only road that is open for flexural impact investigations at this time is that leading to measurements of energy extracted from a known energy source such as a pendulum, falling weight, flywheel, etc. The majority of the investigations of impact have been along this line. Experimental results of a fundamental nature can do much to aid in the development of such theory, as well as serving as a check on forthcoming theories.

Extensive studies are necessary to isolate and determine the effects of velocity, impact capacity, dimen-

sions of specimens, notching, repeated blows, anvil shapes fatigue, etc., for a wide variety of materials at a number of test conditions.

Particular emphasis should be placed upon tensile impact tests involving molded specimens that can be molded with single or dual gates to permit study of weld-line effects. Since such large numbers of specimens are needed for a single material at the wide range of velocities temperatures, humidities, and other conditions, it is essential that the machining of specimens either be eliminated or kept to a minimum.

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—THE END

Reinforced Plastic Flue Assembly

A T-shaped, reinforced plastic flue measuring 24-36 inches in diameter has been fabricated by Peterson Products, San Mateo, Calif. Horizontal section of the T is 85 feet long, while the vertical section measures 46 feet. The entire assembly weighs but 3,000 pounds, and the 5/16-inch thick flue was laid-up in three sections, over a male mandrel.

Dion-Iso laminating resin, reinforced with fibrous glass mat, constitute the entire structure. This high-strength, contact laminating resin is made with Isophthalic, a polyester developed by Oronite Chemical Co., San Francisco, Calif.

Reinforced plastic fume-control ducting.

A. P. LANDALL, *Supervisor*
Technical Service Engineering,
Phenolic Products Sales,
Chem. Matls. Dept., Chem. & Metallurgical Div.,
General Electric Co., Pittsfield, Mass.

Advances in Phenolic Materials and Processes During 1957

THE year 1957 saw the custom molder suffering very serious inroads into his business because of the growing trend toward captive molding. The captive molder requires, as one of the prime reasons for being, fairly long runs on the same molded part. Because he is dealing with relatively few molded parts and because his production runs are of extremely long duration as measured by the average custom-molding run, he is able to employ automation to a degree which may not always be possible with the custom molder. His ability to employ automation makes captive molding extremely attractive economically to him. Perhaps the biggest single stride in the processing of phenolic materials has been, therefore, the advances made in automatic molding equipment.

All manufacturers of completely automatic molding equipment have stressed to a large degree the opportunities that exist for the organization that can take advantage of the automatic molding process. The automatic molding method lends itself to a wide variety of parts. Parts weighing from a fraction of an ounce to more than a pound have been molded automatically in multiple-cavity molds. Even undercuts and inserts are not a deterrent to automatic molding. It is true that the automatic molding of parts containing inserts is not generally done; however, there have been references in the literature to automatic loading of inserts (1).* By means of an oscillating drum and a perforated collector plate, air turbulence forces inserts into the collector plate. This collector plate then is placed manually over the mold, and the inserts are ejected onto the insert-holding pins or insert cavities. Although this process was not developed for automatic molding, it is conceivable that it could be adapted readily through proper mechanical design. Parts with undercuts, such as coil forms, have been molded satisfactorily by the automatic process using special mold designs.

The automotive companies, where automation is practiced to a large degree, naturally have gone into the automatic molding of automotive components (2). The long production runs enable economies which cannot be obtained by any other method. Parts molded in this manner range from ignition rotors, distributor caps, and coil towers to water-pump impellers and various switch components. The Hoover Company has claimed to have molded the largest phenolic part by the automatic method (3). This concern has successfully entered the automatic molding field within the last year at a considerable cost savings.

One of the greatest advances in the art of automatic molding has been that of coupling an automatic molding press and an automatic preheater (see Figure 1). Either powder or pills can be automatically preheated and charged to the automatic molding machine. The preheater picks up a predetermined load of material, transfers it to the preheating chamber, preheats it properly, and charges it automatically into the molding press. It is possible to mold automatically at cycles that rival the best cycles obtained by more conventional molding methods.

Circuit miniaturization has become a necessity with the advent of transistors and other miniature electronic components. This has led to the development of miniature printed paths in laminates for electronic components. Because of the close proximity of the various printed paths, it has been necessary to design circuitry much more carefully than heretofore (4). There have been a number of methods devised for

* Numbers in parentheses refer to bibliography at end of article.

the processing of miniature molded printed circuits. A parallel development, not yet completed, made great strides in 1957. This development consists of molded printed circuits. Considerable economies can be effected by the use of molded printed circuits. Molded-in grooves and through-holes, coupled with special-process plating with copper, yield a high degree of automation and improvement in quality. This method appears to be most ideally suited for small radio circuits and electronic applications where the amortization of mold cost can be tolerated. It is the writer's opinion that the method of molding in printed circuits does not lend itself to other than long-run production jobs.

In order to combat, in part, the threat to the custom molding business by the captive molder, the custom molder has attempted to revitalize his own position by studying new applications and new methods that will enable him to utilize his existing equipment more completely, (and to realize, of course, a reasonable profit for his business). For example, several molders have been successful in introducing molded plastic furniture drawers (5). A substantial majority of such drawers have been molded from phenolics with marked success and excellent market acceptance (5). The equipment used for this application is usually found only in a custom molder's shop; hence, he, above all others, is best equipped to compete in the large molding area.

The compression molder also has considered the manufacture of his own molding material. For example, there has been some activity in the use of phenolic premixes made by the molder, similar to the polyester premix materials which the reinforced-plastic segment of the industry has been using for some time (6). The molder also recognizes that in order to compete he may have to produce on occasion materials of considerable strength, yet at relatively low cost. He has experimented with materials containing lignin in order to extend the use of phenolic resin which is a substantial part of the total material cost (7). Lignin is utilized for resin extension, and sisal for greater strength and economy.

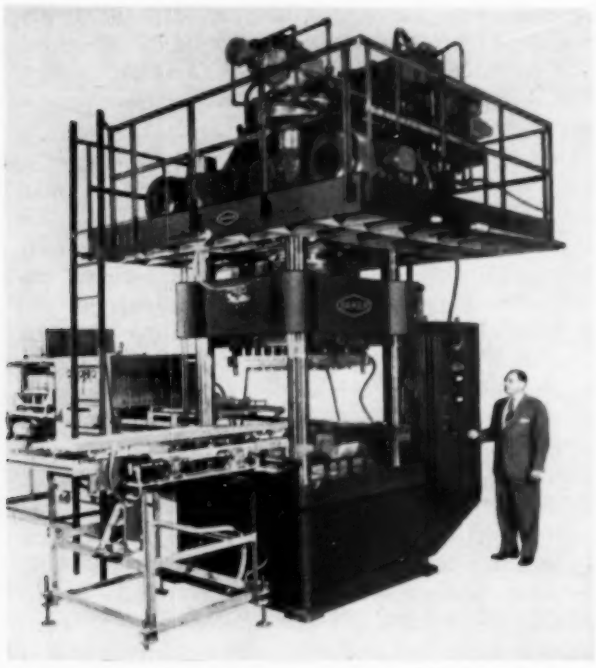

Fig. 1. Large fully-automatic compression molding press in combination with powder preheater is suitable for completely automatic molding of large parts.

The custom molder of phenolic material has long recognized the limitations of phenolic with respect to color. He has been able to work only with black, brown, and some of the darker colors. For this reason alone, many applications have gone over to thermoplastics, and to the ureas and melamines in the thermoset family. The color limitations of phenolics need no longer be a deterrent to the custom molder who wishes to compete on colored articles. Epoxy finishes have been developed that are especially good when used for phenolic moldings (8). These finishes can be sprayed, dipped, or painted in the regular manner. The manufacturer recommends that this type of material be force-dried in an oven. This enables the molder to reproduce articles basically of the phenolic type in a wide variety of colors; in fact, the color possibility is unlimited (8).

Material manufacturers have developed other thermosets that are capable of being molded into delicate pastel colors. These are not true phenolic materials, however, but they can provide versatility for the compression molder's bag of tricks.

The compression molder also has examined improved methods of automatically deflashing his molded parts. The small amount of flash which sticks around small inserts has plagued the molder for a good many years. Methods have been devised for deflashing small inserts economically and automatically (9).

Irish (10), Oberle (11), Woodruff (12), and others have stressed the value of phenolic molding materials, and have emphasized that phenolics are engineered to be used for the unique combination of properties which they possess; i.e., heat resistance, dimensional stability, and resistance to creep under stress. This concept needs to be recognized by the compression molding industry and its customers so that the custom molder might be able to realize a reasonable profit from the molding of phenolic materials. Unfortunately, it has been recognized that phenolic molders are too willing to mold at a selling price which does not return to them a fair margin of profit. For this reason, some education is required to insure the continued high quality moldings that only phenolics can give.

Research groups have not been idle. Considerable work has been done during 1957 with respect to special studies and the development of test methods. Much work has been done on volume and pressure effects in molding so that the molder might obtain understanding of the mechanism of the molding process in order that he might obtain the highest possible quality in his molded parts (13).

Tests also have been devised for determining the hot rigidity of molded phenolic articles (14) so that the molder might select that material which best suits his application (see Figure 2). All too often, a molder is required to devise expensive shrink forms and other devices to make certain that the molded plastic article retains its shape during cooling. This test method

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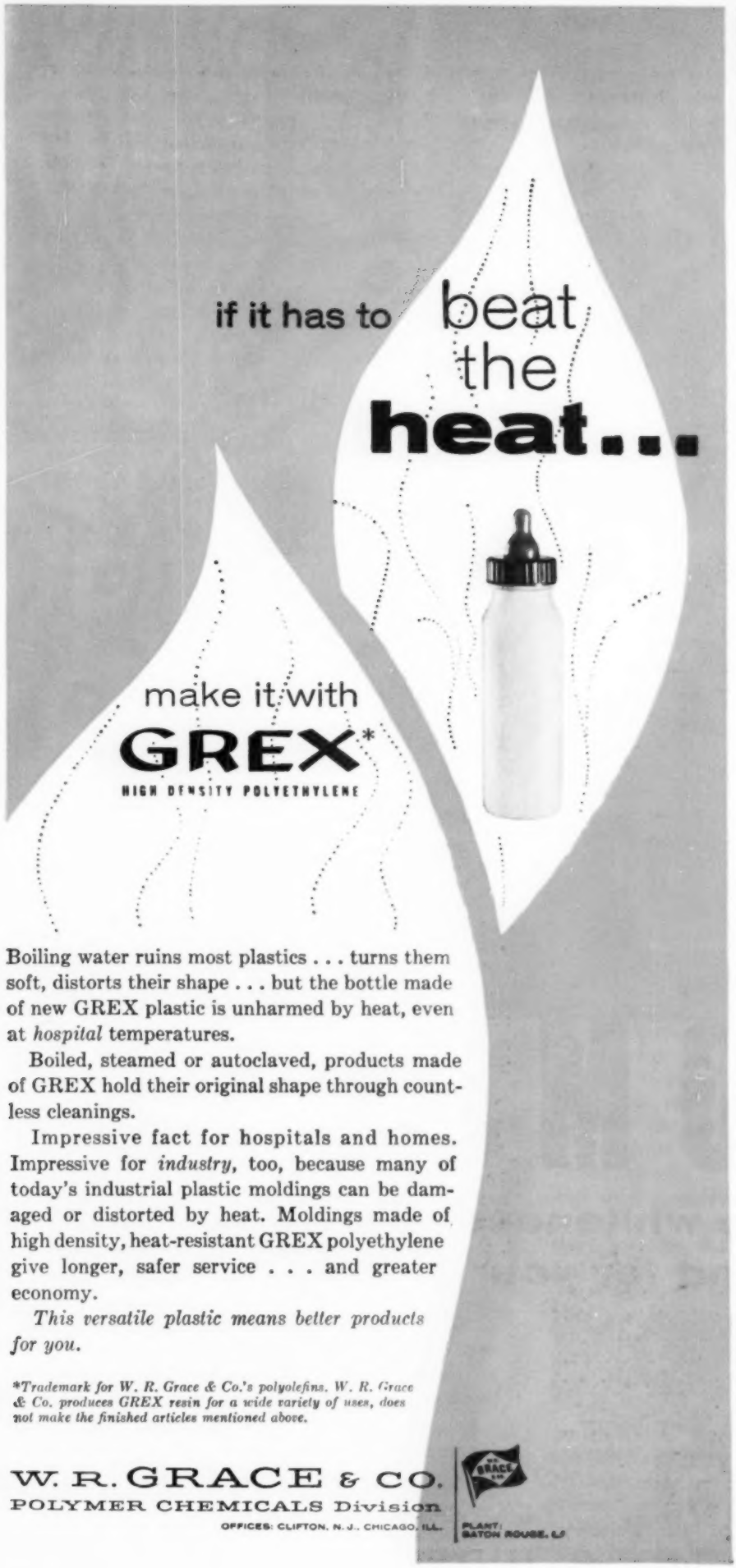

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should enable the molder to determine in advance which material best suits his needs and, thereby, effect economies as a result of not requiring special jigs and fixtures for certain types of moldings. As a parallel to this, tests have been developed that will enable the molder to determine which material will possess the least tool-wear characteristics in a given class of product (15). This obviously is important from the standpoint of tool life during the finishing operation.

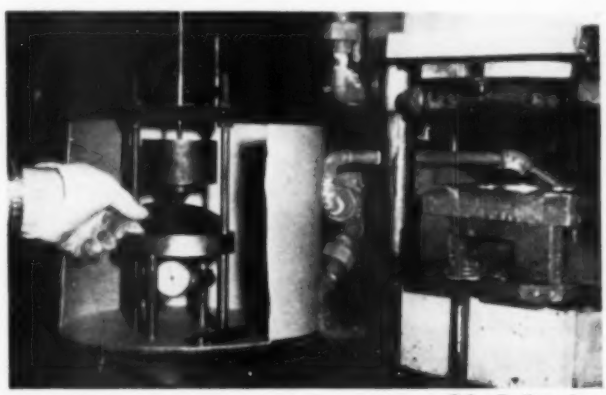
During the past year, material suppliers have been very active. A rather unique product composed of acrylonitrile rubber and phenolic resins, blended on a rubber mixing mill, and then calendered to form a thin, continuous sheet of bonding film, has been used to replace rivets in some parts of supersonic aircraft (16).

Earlier, the remark was made that the phenolic resin component represents perhaps the largest segment of raw material cost in a molding composition. Basic research indicates that a sucrose-phenol-formaldehyde resin might be made that would compare favorably in characteristics with conventional phenol-aldehyde resins (17). The cost of these sucrose resins promises to be markedly lower.

Coupled with these more glamourous developments, all major materials suppliers have been working diligently toward faster and faster curing compounds having even greater latitudes than have been previously experienced. Naturally, considerable impetus and manpower is being expended on the development of fast-curing materials for cold-powder automatic molding and, also, for the newer powder-preheat automatic molding. More conventional applications have not been overlooked. Developments are constantly going on to obtain greater versatility, longer duration of flow, and better finish, together with the other characteristics of the more conventional phenolics. Sisal-filled phenolics have received another shot in the arm because of the requirements for greater impact strength, and it is expected that this field will grow.

Phenolic material suppliers recognize the inherent limitations of phenolic plastic materials. However, there is considerable room for growth, and these growth opportunities should be exploited to the fullest.

The areas of opportunity are many, and machinery manufacturers, molders, and molding material suppliers are cooperating jointly to expand the phenolic market. Phenolic materials today are a far cry from those of just 10 years ago. The quality that has been built into phenolic moldings has enhanced phenolics to the point where the industry can hold its head up proudly, and say with respect to phenolics, "First of the modern plastics, and first in value."



Baker Brothers, Inc.

Fig. 2. Hot rigidity test enables molder to predetermine selection of the material best suited for his application.

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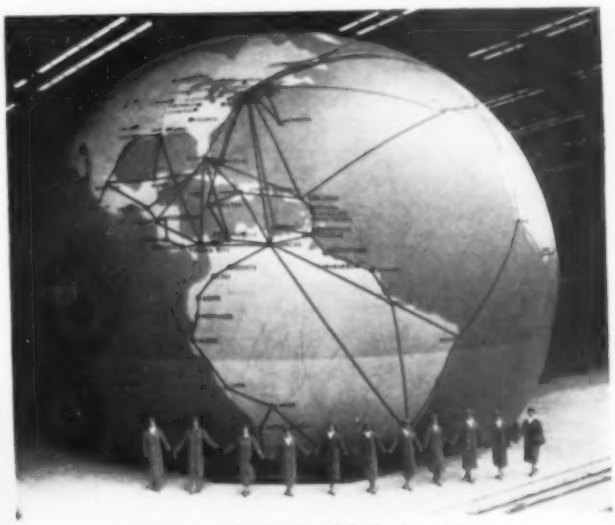
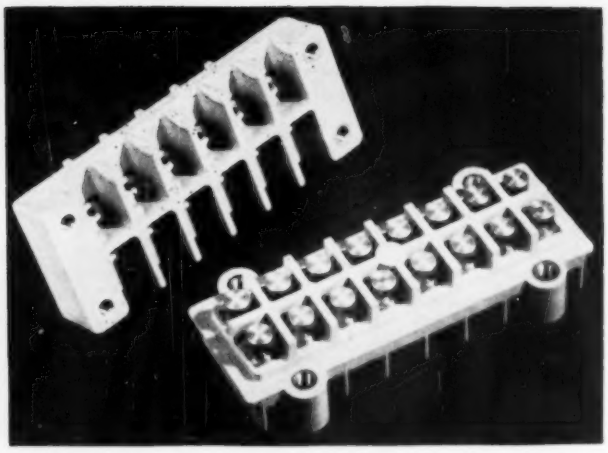


Air-supported plastic global planetarium.

Fiberthin Globe at Brussels Fair

A global map inflated by 70,000 cubic feet of air will serve as a planetarium at the Brussels World's Fair.

Approximately 1,000 yards of Fiberthin, U. S. Rubber's vinyl-coated nylon fabric, were used by Irving Air Chute Co., to make this "greatest earth on earth" for Pan American Airlines.



Molded alkyd terminal board has both thick and thin sections.

Intricate Plastic Moldings

The molding of or around inserts to precision tolerances involves processing skill and the choice of a dimensionally stable material. Our cover this month was chosen to demonstrate both. At the upper left, we show terminal boards for the electric heaters in the new Lockheed Electra Turboprop Airliner. These boards are molded of Plaskon Alkyd 446 by Maas-Rowe Carillons, Los Angeles, Calif., together with a large number of inserts which vary widely in cross section. This means that each board includes thin barrier webs plus heavy-walled sections around the inserts.

At the lower left, we show a one-piece brush holder which fits over the commutator end of a miniature electric motor. Molded of Plaskon Alkyd 440A, it incorporates brush guides and molded-in contact terminals. The terminals also serve as supports for torque springs, which operate through slots and apply pressure against the brushes. The latter, in turn, contact the commutator. Here, Gaylord Plastics, Inc., has taken advantage of the material's electrical insulating characteristics as well as its structural strength and dimensional stability.

At the right, we show the complex commutator assembly used by IBM in its electronically-operated, high-speed IBM card-sorting equipment. The center hub insert, brass plate, twelve terminal inserts, and copper ring are held in place by the orlon-filled diallyl phthalate used for the aforementioned inserts. Specialty Insulation Mfg. Co. produces the part in a two-cavity mold; partially by compression, partially by transfer molding. The material used here is Durez 16694, a product of Hooker Electrochemical Co.'s Durez Plastics division. The Plaskon alkyd materials mentioned in the two preceding applications are products of Allied Chemical & Dye Corp.'s Barrett division.

Use of Radiation Gages in Plastics Extrusion

(*continued from page 347*)

will be direct aid to management. This has been initiated by the large business computers which make it possible to predict future trends or determine optimum methods of operation.

The usefulness of these computers today often is limited by the lack of accurate, timely data. Equipment is being rapidly designed and installed on processes to gather, reduce, and read-out this desired data. The closing of the management loop by speeding the flow of process information will make possible an improvement in management performance in the same magnitude as given by feed-back control of processes. In this connection, Figure 9 shows a simple read-out system for extruder operation.

Summary and Conclusions

In summation, the results achieved on various extrusion processes are excellent from both quality and economic standpoints. The mass application of source-detection equipment has begun, and it is probable that it will become a standard tool within the next few years. Through the use of this equipment as a process engineering tool, the performance of extruders can be improved materially.

Extruder manufacturers could make more use of this approach. By standardization of operating conditions, the through-put and quality of product can be maximized. With fast, accurate production data, management can effect savings because of closer control of production, inventory, and personnel. In today's competitive market, improved quality and reduced costs are essential for the maintenance of satisfactory operating profit margins. —THE END

News of the Societies

ASTM Forms Solvents Group

Preliminary work has commenced on the formation of a halogenated organic solvents committee within the structure of the American Society of Testing Materials, Philadelphia, Pa. Designated Committee D-26, the group will be inaugurated formally at the Society's annual meeting to be held June 22-27 at the Hotel Statler, Boston, Mass.

The committee's work will include formulation of test methods, definitions, and specifications pertaining to halogenated organic solvents and their admixtures. Excluded will be those standards peculiar to electrical insulating liquids, paint thinners, and non-halogenated components. Developments in these fields, incidental to the work of D-26, will be coordinated with the appropriate technical committees of the society. Subcommittees have been proposed to cover definitions and nomenclature, vapor degreasing, cold cleaning, test methods and industrial hygiene and safety.

Plastic Pipe Program

An educational program, designed to acquaint members of the plumbing industry as well as the consuming public with the advantages of plastic piping, has been undertaken by the Plastic Pipe Research Council, Society of the Plastics Industry, Inc., New York, N. Y. Simultaneously with this announcement, the Council issued a summary of the progress that has been made in providing uniform standards for plastic piping to encourage its acceptance for both industrial and domestic use.

A 12-page brochure entitled "Safe Transportation of Drinking Water—Your Key to Public Health," supplemented by a 35 mm., 100 frame color film strip may be obtained by dealers and distributors from their plastic pipe and fittings manufacturers. Both booklet and film tell the story of the National Sanitation Foundation's approval of plastics pipe for the transmission of drinking water, and describe suggested uses, case histories, and approved methods of installation. The film has a synchronized, recorded commentary on a 12-inch, 33-⅓ rpm. record.

Research activities have been undertaken by the National Sanitation Foundation at University of Michigan's School of Public Health, and by the Plastic Pipe Research Council in cooperation with the U. S. Department of Commerce and the National Bureau of Standards. Out of these efforts have emerged basic requirements which must be met to insure good quality and eliminate the possibility of contaminants. To date three commercial standards on plastic pipe have been defined: CS 206-57, on solvent welded cellulose-acetate butyrate pipe; CS 207-57, specifying dimensions and tolerances for rigid PVC piping; and CS 197-57, which deals with flexible polyethylene pipe.

ACS Elects 1958 Officers

American Chemical Society's division of paint, plastics, and printing ink chemistry has announced its election of 1958 officers as follows: chairman, L. Reed Brantley, Occidental College; chairman-elect, Allen L. Alexander, Naval Research Laboratory; vice-chairman, Walter A. Henson, Dow Chemical Co.; and secretary-treasurer, Ernest R. Mueller, Battelle Memorial Institute.

Representing the division on the A.C.S. council will be John K. Wise, U. S. Gypsum Co., and Ellsworth E. McSweeney, Battelle Memorial Institute. Arthur K. Doolittle,, Union Carbide Chemicals Co., and A. C. Zettlemoyer, Lehigh University, are alternate councilors.

ASME Elects Schier

O. B. Schier, II, has been appointed secretary of the American Society of Mechanical Engineers, according to a recent announcement made by that organization. A member of the society since 1932 and a staff member for 11 years, Mr. Schier succeeds Clarence E. Davies who has been secretary since 1934.

Elects Divisional Chairman

Donald R. Meserve, Metal & Thermit Corp., has been elected chairman of the vinyl dispersion division, Society of the Plastics Industry, Inc. This group currently is working with the National Bureau of Standards and the American Society for Testing Materials to develop standard test procedures which will be used in determining the quality and characteristics of vinyl dispersions.

At the left, James S. Lunn presents executive committee award to Ray B. Crepps. On the right is Edward Jonasch, co-recipient.

Confers Society Awards

Executive committee awards for outstanding service to the plastics industry during 1957 were conferred on Ray B. Crepps, Owens-Corning Fiberglas Corp.; and Edward Jonasch, Jonasch Plastics Div., Osborn Mfg. Corp.; in a ceremony held at Chicago, Ill., during the 13th Annual Conference of the reinforced plastics division, Society of the Plastics Industry, Inc. The awards were presented by James S. Lunn, chairman of the executive committee and president of Lunn Laminates, Inc. Also honored for his services as a member of the policy committee and as divisional chairman from 1956-1958, was Clare E. Bacon of Owens-Corning Fiberglas Corp.

SPE Eastern New England

The eastern New England section of the Society of Plastics Engineers, Inc., met Thursday, February 20, at the Hotel Beaconsfield, Brookline, Mass. Topic for the evening's discussion was "Molded Plastics in the Shoe Industry."

Carl Seibert, Eastern Plastics Co., and Les Ewing, National Heel Co., spoke on "Plastics for Women's Shoe Heels," and discussed the material and methods used in the injection molding of these items.

Murray L. Aibinder, Foster Grant Co., presented a paper on "The Applications for Nylon in the Shoe Industry." Pointing up the increased use of nylon materials in shoe heels, he discussed the physical properties of Nylon 6; described a fatigue test that simulates walking conditions; and concluded his talk with a comparison of nylon with other commercial materials currently in use.

Concluding the program, a short film on "The Injection Molding of Shoe Bottoms," prepared by United Shoe Machinery Corp., was presented by John Bergrenn of that company. Mr. Bergrenn answered questions on the equipment developed for this purpose, and claimed that the most successful materials have been those based on PVC resins.

News of the Industry

Enters Thermoforming Field

A new corporation, Robinson, Lewis & Rubin, Inc., has been set up for the expressed purposes of vacuum forming, low pressure forming, and fabricating plastic sheet material. Located at 132 Lafayette St., New York, N. Y., the firm offers proprietary industrial items and custom molding services. Materials handled include acrylic, styrene, copolymer, polyethylene, and high-impact polystyrene sheeting.

The firm's equipment can handle sheets measuring up to 50 by 50 inches by vacuum, or up to six by six feet by pressure. R-L-R engineers are available for research and development consultation with customer personnel, and include men with considerable experience in the plastics field.

Daniel Lewis has been elected president of the new corporation. He formerly served as sales manager for Durable Formed Products and as vice president of Tiger Plastics Corp. Associated with Mr. Lewis are S. M. Robinson, Irvin I. Rubin, and Irwin Robinson; president, vice president, and treasurer, respectively, of Robinson Plastics Corp.

Concludes License Agreement

Regular and special types of nylon 6 plastic materials, developed by Farbenfabriken-Bayer, A.G., Germany, will be manufactured and sold in this country under the terms of a recently-concluded license agreement with Foster Grant Co., Inc., Leominster, Mass. Until such time as the American firm can install equipment to utilize the Bayer processes, they will be permitted to import and sell these products.

Among the special types of nylon 6 to be introduced is one having a high crystalline characteristic. It reportedly can be molded over wide pressure and temperature ranges. Another type has outstanding weathering characteristics; will not embrittle, oxidize, or yellow; and is particularly suitable for wire and cable coatings. Still other types include a hot water resistant nylon that can withstand sterilization temperatures and should find application in pump impellers, and surgical instrument handles; an ultra-high viscosity type, that is easily handled under molding and extrusion conditions; a nylon 6 containing graphite; and another containing molybdenum disulphide which is specially formulated for use in anti-friction bearings. All of the Bayer products to be handled are in addition to the regular grades of nylon which will be manufactured at Foster Grant's plant at Manchester, N.H.

Expands Production Facilities

Staging its fourth major expansion in pentaerythritol production, Heyden Newport Chemical Corp., New York, N.Y., has opened an automated plant for this industrial chemical at Fords, N.J. Heyden, who has been manufacturing pentaerythritol since 1939, will increase its total annual capacity by 25-million pounds with this latest addition to its facilities.

Tradenamed Pentek, this chemical intermediate finds primary applications in weather-resistant, quick-drying paints, enamels, resins, and other surface coatings. More recent research on lubricants and lubricant additives indicates large potential uses for its derivatives in a number of military and civilian applications.

A salicylaldehyde facility also will go into operation at the Fords location in the near future. Employing a new catalytic process that is different from current production methods, the plant will produce annually more than one million pounds of this intermediate which is used in the manufacture of dyestuffs, odor bases, and rubber and petroleum additives.

Cultivates European Market

Hoping to exploit a growing European demand for structural adhesives and laminating materials, Narmco Resins & Coatings Co., Costa Mesa, Calif., has embarked on an accelerated overseas merchandising program designed to expand sales and technical service activities in that area. Tentative plans call for additional company offices to be established in France, West Germany, Holland, Italy, and England. These will supplement Narmco's first overseas field office, Auto Products, A. B., which commenced operations last December in Stockholm, Sweden.

Purpose of this overseas program was explained by company president and general manager, Clifford W. Brown, who, after an extensive market survey found: ". . . First, the European demand for structural adhesives and structural plastic laminating materials, particularly in aircraft and missile fields, is rising rapidly. Second, while European firms are supplying some types of adhesives and fabricating materials, their product lines generally do not match those of American suppliers either in versatility or range of performance properties. Third, the use of structural adhesives and structural plastics in non-military industries in Europe is developing even more rapidly than in the United States, particularly with the introduction of a variety of new light-weight, high-strength industrial and commercial products."

Integrates Foreign Operations

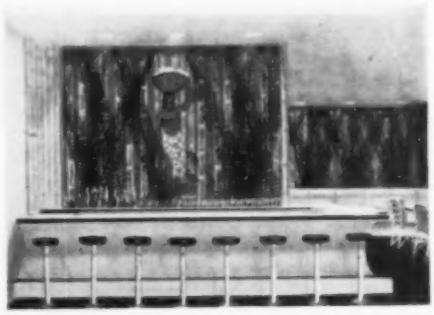
A foreign operations division, coordinating all of the company's overseas marketing and production efforts, has been formed by American Cyanamid Co., New York, N. Y. Known as Cyanamid International, the division is headed by Sydney C. Moody, vice president for international operations, who has been named to the new post of director-general.

In addition to marketing, manufacturing, and servicing all of Cyanamid's products abroad, including those of its subsidiary and associated companies; the division will be instrumental in the interchange of product and process licenses with foreign firms. Integration of these activities is expected to facilitate service to the overseas trade which contributed, during 1956, approximately $68-million or 13.6% of the company's total sales.

Forms Art Department

A decorative art department, whose staff will work with architects, builders, and other customers interested in laminated plastics art work, has been formed by Formica Corp., Cincinnati, O. Original paintings, reproductions, and random patterns are utilized to provide murals, counters, and wall surfaces that will outlast other artistic media used in those applications.

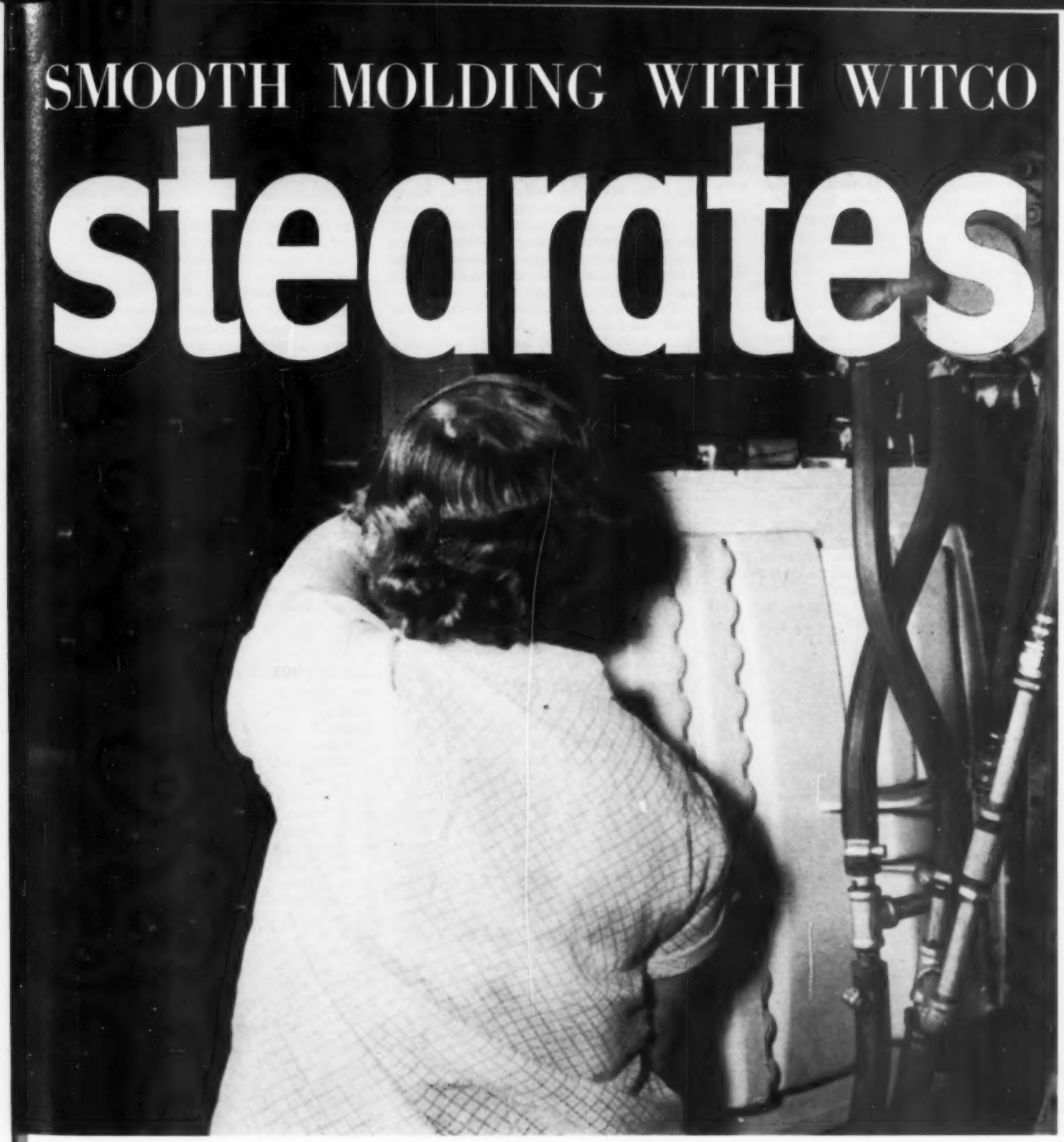
Processes being used at Formica include inlay, in which sheets of impregnated paper are cut to desired shapes and laid into the laminate prior to the final pressing operation; artlay, a silkscreen method for reproducing special patterns and designs; and hand-painting to produce original artwork or reproductions. All of these techniques can be used separately or in combination to achieve a desired decorative effect.



Formica wall covering, done by the artlay process, shows a hand-painted woman surrounded by foliage.

SMOOTH MOLDING WITH WITCO

stearates



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- **Witco 77-86 Coupler**
- **Witcarb® Extenders**
- **Carbon Blacks**

Establishes Bachner Award

Both symbolic and monetary recognition for outstanding practical applications of plastics will be granted this year with the inauguration of the Bachner Award, sponsored by Chicago Molded Products, Inc., Chicago, Ill. The award will consist of a plaque, executed entirely in plastics materials by industrial designer Jean Reinecke, and a cash prize of $1,000.

Presented every 2½-years, concurrent with SPI's National Exposition and Conference, the plaque will be presented to the winning company, while the prize money will go to the person or persons whom the winning manufacturer designates as most responsible for the achievement.

The award has been established as a testimonial to the work of the five Bachner brothers who founded Chicago Molded Products, Inc., and to the many others who have contributed to the growth of the industry. Competition is open to all manufacturers of molded, extruded, and vacuum- or pressure-formed products, and to those who use a component of this type in other applications.

A panel of judges, chosen by the Bachner Award Committee, will select the winning applications. Products may be entered until August 15, 1958, and applications may be obtained through William T. Cruse, Society of the Plastics Industry, Inc., 250 Park Ave., New York, N. Y.

Opens Research Center

The first of two main laboratories, located near Clarksville, Md., was opened recently as part of the consolidation of research activities formerly executed individually by W. R. Grace & Co.'s Davison Chemical Div., Baltimore, Md., and Grace Research and Development Div., New York, N. Y. The newly completed building encloses an area of 55,000 square feet to provide working space for approximately 160 people, most of whom are engaged in inorganic research in the fields of catalysts, silicas, and agricultural chemicals. The second laboratory, scheduled for completion this summer, will house facilities for research in polymers, petrochemicals, and chemical intermediates.

Builds Epoxy Resin Plant

An epoxy resin plant, scheduled for commercial production early in 1959, is being built at Marietta, O., by Bakelite Co., New York, N. Y. Designed for an annual output-capacity of 15-million pounds, the plant will augment the firm's epoxy resin facility at Bound Brook, N. J., and enable them to provide better service to the Chicago-Detroit area and points west. With this added capacity, the company hopes to capitalize on the increased use of epoxies in piping, laminated structures, and in potting and encapsulating applications.

Makes Resin-Grade Polyglycols

Seven resin-grade polyglycols, whose volatility, unsaturation, and ash content meet urethane industry requirements, are being produced commercially by Dow Chemical Co., Midland, Mich. The group includes one diol and six triols, all of which are based on glycerine with propylene oxide as a building block. Special properties include a narrow pH range; low water content; narrow molecular weight range and distribution; absence of harmful ash; and low carbonyl level.

The triols are members of Dow's recently-introduced "11" series and include the following: 11-80, for rigid and semi-rigid foams and urethane coatings; 11-100, for semi-rigid foams; and 11-200, -300, and -400, for flexible foams. The second number in the "11" series identification, indicates the material's viscosity in centistokes at 100° F. Designated 112-3, the sixth triol is intended for flexible foams where essentially all primary terminal hydroxyls are desired. The diol, P-2,000, is used in flexible foams and elastomers. In this case, the number 2,000 expresses the diol's molecular weight.

Opens Radome Test Center

A test facility for reinforced plastics radomes, reportedly the largest privately-owned installation of its kind in the U. S., has been designed and built by Zenith Plastics Co., Gardena, Calif. Available as a test center on an industry-wide rental basis, the installation is equipped with a three-story master control center and six radially-dispersed test towers that have been checked against government-owned installations and have received Air Force and Navy approval.

The equipment is adequate for running transmission, reflectivity, beam bending, and pattern distortion tests, in addition to determining dielectric constants and loss tangents for basic materials prior to their use in radome manufacture. A radome test range is used for long distance tests and for checking radomes too large to be handled by the towers. Between the two facilities, unit diameters up to 40 feet can be completely pre-tested and ready for use on delivery. A tip-up slab construction minimizes the effects of winds on the towers and helps provide maximum test control.

Forms Plastics Division

The Linen Thread Co., Inc., New York, N. Y., has announced the formation of a plastics division to handle production and sales of its closed-cell PVC foamed products. Called Akron Plastics Division, the subsidiary is headquartered at Paterson, N. J., where it manufactures fishing net floats, innersoles, boat fenders, insulation, and athletic equipment. Its activities are directed by D. H. Spitzli.

Egan's plant at Somerville, N.J.

Adds Laboratory Facilities

A 16,000 square-foot wing costing $165,000 has been added to the facilities of Frank W. Egan & Co., Somerville, N. J. Part of the structure will be devoted to testing and research in the plastics extrusions and paper converting fields.

The plastics section is equipped with a 2½-inch extruder and a complete line of auxiliary equipment; while the paper converting section has an experimental dryer, various types of coating heads, and an unroll and winder capable of handling web widths up to 18 inches. The paper converting section will carry out further experimental work on the company's recently-developed, high-velocity drying process.

Plastic Dinnerware by Lenox

A fine-china manufacturer, Lenox, Inc., Trenton, N. J., has departed from its traditional role as a producer of ceramics art-work solely, with the acquisition of a plastics dinner-ware firm, Branchell Co., St. Louis, Mo. The $2-million purchase was revealed in a joint announcement made by the two companies at the China, Glass, and Pottery Show held recently in Pittsburgh, Pa.

Lenox was founded in 1889 by Walter Scott Lenox in the belief that American ceramic art could be raised to, or above, the level of existing European potteries. Acquisition of the plastics facilities will permit the company to produce a low-price product without detracting from the prestige of its fine-china line by the manufacture of a second-grade ceramic.

Branchell, who makes dinnerware under the tradenames Branchell, Royale, Color-Flyte, and Aztec, will become a subsidiary company named Lenox Plastics, Inc. Its St. Louis headquarters and plant, together with another facility in Puerto Rico, will continue operations under the same management including production and sales personnel.

Techni-Plastics, Inc. Formed

A new corporation which will engage in plastics thermoforming and fabricating has been organized as Techni-Plastics, Inc. Address of the firm is 4 Yennicock Ave., Port Washington, N. Y., The following men will serve as officers and directors: Vito Tanzi, president and chairman of the board; Walter R. Speck, vice president; Robert A. Gerardi, treasurer and general manager; and Gilbert G. D'Andrea, secretary.

Develops Packaging Process

A new means of skin packaging which requires no special coating or perforating of the package board has been developed by Print-A-Tube Co., Rochelle Park, N. J. Using a new film, Poly-on-Mylar Vacuumized, the company has speeded the packaging cycle and opened the door to automation in skin packaging.

Since coating is eliminated, there is no oxidation or discoloration of stored boards. Small quantities of items can be packaged at a time, thus eliminating stock-piling. Savings up to 50% have been reported. Once packed, the shelf-life of P.O.M.V. is practically indefinite. Resistance to tearing is assured, and the tough film can be used in gages as thin as 1-2.5 mills. It is particularly useful in the packaging of sharp, hardware items.

Simplifies Resin Nomenclature

A decision by the Society of the Plastics Industry, Inc., to simplify the description of fluorocarbon resins, has resulted in a revision of the nomenclature of Teflon products made and marketed by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Henceforth, Teflon tetrafluoroethylene resins will be identified by the common name, TFE-fluorocarbon resins. Teflon 100-X, which is derived from fluorinated ethylene propylene, will be known as FEP-fluorocarbon resin. SPI's fluorocarbons division has urged that the two generic terms be used as a means to avoid confusion between the properties of the two classes of materials.

Aids Science Education

Supporting science education and research, E. I. du Pont de Nemours and Co., Wilmington, Del., has contributed more than $1-million in grants to 135 colleges and universities. This total for the 1958 academic year represents a $100,000 increase over last year's grant.

Most of the stipend will be channeled toward the education of scientists and engineers. Included in the program are teaching grants amounting to $664,000; aids to fundamental research, $309,000; and post-graduate fellowships, $155,000.

Builds Research Facility

A product development laboratory and pilot plant for American Cyanamid's plastics and resins division is currently under construction at Wallingford, Conn., site of the firm's plastics production facilities. It is scheduled for occupancy late in 1958, at which time the company plans to consolidate its present plastics development work and technical sales service at the new location.

Develops Coding Method

Punched, laminated plastic panels can be color-coded inexpensively with an automatic printing system developed by Taylor Fibre Co., Norristown, Pa. The coding can be printed on any tape laminate in a single operation, after the panel has been punched. Used in conjunction with electrical and electronic equipment, color-coding provides a positive identification of contacts and terminals to speed assembly and reduce chances of incorrect wiring.

Bakelite Opens First of Two High Density Polyethylene Plants

A fully-automated plant for producing high density polyethylene by the Ziegler method has been placed on stream by Bakelite Co. Located at Institute, W. Va., the facility has a planned capacity of 30-million pounds annually. In line with the company's policy of extensive material testing before market introduction, Bakelite has over a year's test results upon which to rely. Property data and detailed information on fabrication techniques are available to processors (see New Materials Section, this issue).

Another high-density polyethylene plant, located in Seadrift, Tex., will produce Phillips-type resins and should be in commercial production approximately one month from now. These facilities are scheduled to produce 25-million pounds yearly, and will enable Bakelite to offer the broadest range of densities in polyethylene resins.

As with other Union Carbide polyethylene plants, Union Carbide Chemicals Co. built the two plants, and Bakelite Co. will direct operations, sales, and technical services.

Central control panel at Bakelite's new high-density polyethylene plant, Institute, W. Va.

Votes On Name Change

Stockholders of the 38-year-old Allied Chemical & Dye Corp., New York, N.Y., will vote this month on a proposal to change the company name to Allied Chemical Corp. The recommendation will require an affirmative majority vote, and if approved will become effective May 1.

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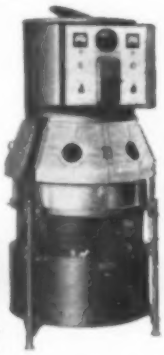

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Names in the News

Charles E. Trescott

Charles E. Trescott has been named manufacturing manager of Zenith Plastics, a subsidiary of Minnesota Mining & Mfg. Co. A retired navy captain, Mr. Trescott has served in many technical and administrative capacities in the Navy's department of marine engineering.

Theodore W. Hummel has been named a plastic materials sales representative for B. F. Goodrich Chemical Co. He will maintain headquarters in New York City.

Duane Roland, former general manager of production for Synthane Corp., Oaks, Pa., has been elected to the board of directors of that firm. A Synthane employe since 1929, he retired approximately six months ago.

William F. Dolan, Jr., has been appointed technical sales representative for Nopco Chemical Co.'s industrial division in North Carolina and the eastern part of Tennessee.

Nicholas C. Gangemi

Nicholas C. Gangemi has been appointed director of research for Pennsylvania Industrial Chemical Corp. A Picco employe since 1946, he will maintain offices in Chester, Pa.

A. M. Lipscomb has been added to the Pacific Coast sales staff of Baker Castor Oil Co. Based in Los Angeles, he will handle sales and technical service to the Southern California area.

Robert C. DeLollis has been appointed sales representative for Emery Industries, Inc., in the Middle-Atlantic states. He succeeds **P. N. Leech,** who recently was transferred to the Chicago office.

Jeremiah J. Sullivan, Jr., has been named sales engineer with Taylor Fibre Co., Norristown, Pa. He will cover the Philadelphia area.

Robert O. Nellums has been appointed assistant director of research for Monsanto Chemical Co.'s organic chemicals division, St. Louis, Mo. He formerly served as section leader in the division's research department.

D. S. Herr, former director of Shell Chemical Corp.'s technical service laboratory in Union, N. J., has switched positions with **F. S. Swackhamer,** former manager of the sales development department, chemical sales division. The change is expected to give both men "a broader background of experience," according to **L. V. Steck,** vice president of marketing.

Fred Y. Walters, Jr.

Fred Y. Walters, Jr., has been appointed manager of F. J. Stokes Co. of Canada, Ltd., a subsidiary of the Philadelphia firm. He joined Stokes of Canada as a sales engineer in 1955.

Ray Stratman has been appointed sales manager, housewares division, for Victory Mfg. Co., a Chicago thermoplastics molder. **Arthur E. Backus** has been named manager of industrial and custom molding.

William H. Rader

William H. Rader has been made assistant production manager, Petrothene polyethylene resins, for U. S. Industrial Chemical Co. He joined the firm in 1953 as senior technologist, and has served as senior development engineer in charge of polyethylene development at the Tuscola, Ill. plant.

Daniel McC. Collette

Daniel McC. Collette has been named manager of manufacturing for American Cyanamid Co.'s plastics & resins division. He succeeds **William D. Holland,** new assistant general manager of the commercial development division. Mr. Collette, in turn, is replaced by **Vladimir J. Wilhousky** as manager of the Wallingford, Conn., plant.

Vladimir J. Wilhousky

Philip Greene has been appointed sales manager for Davis-Standard, a division of Franklin Research Corp. A former salesman in Connecticut, he is replaced by **John McCormick.** Other additions to the firm's sales and service representative staffs include **Louis Dziedzic, Erle Morgan, Marcus Jones,** and **Douglas Laplant.**

James R. Caldwell

James R. Caldwell has been appointed technical director of Resin Formulators, Inc., Los Angeles, Calif. He formerly served as chief research engineer for Century Engineers, Inc., and Waldrip Engineering Co. His new firm specializes in the production of formulated epoxy resins, for potting, encapsulating, and coating of electronic parts.

Walter W. Goehring has been appointed manufacturing department manager for F. J. Stokes Corp., Philadelphia, Pa. He formerly occupied the same position with Crown Cork & Seal Co., Inc.

Al Schwider has been appointed manager of Hastings Plastics' structural division. He previously served as a chemical engineer with Dow and as plant manager of Honeycomb Structures.

James Gillen

James Gillen has been appointed sales manager of upholstery sheeting for General Tire & Rubber Co.'s Pennsylvania Plastics division. He replaces **John Donovan,** who was promoted to sales manager of sheeting and unsupported fabric at General's Respro division, Cranston, R. I.

Thomas Zawadzki

Thomas Zawadzki has been elected vice president in charge of sales and a member of the board of directors for Cary Chemicals, Inc., Milltown, N. J. He formerly served with General Cable Corp., and with Firestone Plastics Co.

Frank Russo

Frank Russo has been appointed sales service manager of General Tire & Rubber Co.'s Bolta Products division. He replaces **J. A. Wilcox,** who has been named production control manager.

Herbert G. Vore

Herbert G. Vore has been appointed technical director of Improved Machinery, Inc., Nashua, N. H. Before joining the firm in 1954 as development engineer, he served as technical director of American Seal-Kap Corp. **Frank Z. Bailey** has been named sales manager for the firm. He has been an IMPCO sales representative since 1946.

Charles H. Rybolt

Charles H. Rybolt has been appointed director—chemical divisions for Wallace & Tiernan, Inc. He will retain his present status as general manager of the Lucidol division, a position he has held for the past four years. Mr. Rybolt joined W&T in 1941.

H. Curtis Colby, Jr

H. Curtis Colby, Jr., has been named manager of market development for the specialty products manufactured by Foster Grant Co.s' polymer products division. He joins the firm after 13 years in plastics and organic chemical sales.

Iver G. Freeman

Iver G. Freeman has been named vice president in charge of research & development for the Reed-Prentice division of Package Machinery Co. He joined the division as a vice president in 1954, prior to which time he was works manager with Norton Co. **J. Joseph Kelly** has been elected vice president in charge of the division's sales, and **Edward W. Forth** becomes vice president in charge of machine tool activities. A vice president for the past year, Mr. Kelly had been field sales manager with Package Machinery. Mr. Forth previously served as vice president and general manager of American Machine & Foundry Co.'s cycle division.

The New York Academy of Sciences has elected **Guilio Natta** a Fellow of the Academy in recognition of his achievements in polymer chemistry. A professor at the Polytechnic Institute of Milan, Dr. Natta developed a number of stereospecific catalysts for the production of "isotactic" poly-propylenes.

David J. McKay, Jr.

David J. McKay, Jr., manager of Central States Paper & Bag Co.'s plastics division, has been elected executive vice president of the National Flexible Packaging Association. This organization comprises over 150 business firms and includes the country's leading producers of paper, plastic, and foil packaging.

Elmer N. Hokanson has joined the Mearl Corp., producers of pearl essence. A former Du Pont employe, he will be responsible for product application and development work.

Keith R. Cranker

Keith R. Cranker has been appointed director of research and development for Plumb Chemical Corp., manufacturer of Fibercore molding compounds. He formerly served as assistant manager of the technical service department for Thiokol Chemical Corp.

Frank May

Frank May has replaced **Eric Blackstead** as general manager of Ansbacher-Siegle Corp., a division of Sun Chemical Corp., Long Island City, N. Y. Mr. Blackstead was recently elected a vice president of Sun, and is serving as general manager of its chemical group. Mr. May is the former plant manager.

Matthew S. McCauley has been appointed director of marketing research for Monsanto Chemical Co.'s organic chemicals division. He previously served as director of business research.

Richard G. Bauman has been appointed senior scientist, physical research department, at the B. F. Goodrich Center, Brecksville, O. He joined the firm in 1950 as a chemist.

News from Abroad

MacroPlastic in Amsterdam

MacroPlastic, the first Netherlands International Plastic Exhibition, held in Amsterdam November 13-17, 1957, was as great a success as the international plastics industry evidently expected it to be. Some 300 companies from 13 different countries showed their products at 172 exhibits, and 40,000 visitors came to see the fair, including hundreds of foreigners from 30 different countries. Dutch firms accounted for almost half the number of exhibitors, but they included various agencies for American, British, French, and other foreign concerns.

Germany, represented by its leading producers of materials and machinery, as well as fabricators, accounted for the greater part of foreign participation, and German manufacturers, particularly of machinery, were reportedly well pleased with sales. At the same time, they also were full of praise for the quality and finish of the Dutch exhibits. Next in number came the British firms; they, too, admired the Dutch products and the organization of the Fair. The members of the British Plastics Federation had a very large joint display, but several British companies had independent displays. The proportion of American participants was relatively low. France, Italy, Belgium, Switzerland, Sweden were among the other countries represented.

The specialties of the big European and British producers of plastic materials are sufficiently well-known to need no special comment, but a few of the more recent developments may be mentioned. Algemeene Kunstzijde Unie, of Arnhem, featured new grades of Akulon nylon granules in several standard colors intended for very fast cycling injection molding. This concern produces nylon 6, based on caprolactam, and has lately also begun to make Nylon 66 from raw materials supplied by the State Coal Mines.

A variety of basic materials for the plastics industry, such as phthalic acid anhydride for alkyd resins and plasticizers, cumarone oil for cumarone resins, and urea are produced by States Mines, which is soon also to produce polyethylene. A plant is being built that is expected to be ready to begin producing I.C.I. high-pressure polyethylene by the end of 1958 or beginning of 1959. In addition, a pilot-plant is making Ziegler-type polyethylene. Products of the State Mines were shown at the exhibit of Netherlands Sales Office for Chemical Products, which also represented several well-known American concerns, in addition to French, Swedish, and Dutch manufacturers of basic materials for the plastics industry.

Mention also can be made of a new silicone-based molding powder and a new nonflammable, transparent polyester resin, Thodester 1511, shown by the French Société Rhone-Poulenc, Paris.

As regards applications of plastics, this fair was largely industrial, although various articles for the home, sports and camping were also to be seen. Among others, there were attractively designed PVC flooring, floor and wall tiles, curtains and leather cloth; sink and drain-board units of nylon, reinforced polyester resins, as well as of acrylic resins; foamed polyurethane inner-spring mattresses as thick and "springy" as those of foamed rubber; Tempex, a special type of industrial flooring, consisting of laminates of concrete slabs over metal-reinforced, expanded polystyrene; deep-drawn refrigerator linings of unusual depth that were made by a Swedish company from high-impact polystyrene by a combination of vacuum and pressure molding on a special machine of its own design.

Technical applications included a wide range of piping made of rigid PVC; some piping in unusual widths from reinforced polyester resin; polyethylene pipe reinforced with glass fiber-polyester resin; polyethylene and reinforced polyester resin tanks and large containers; large metal containers and drums with removable polyethylene linings; hexagonal polyethylene containers holding 60 liters each, which can be packed in honeycomb fashion to take up a minimum of space; and very large polyethylene containers made by the American Delaware sintering process.

Of the numerous applications of reinforced plastic, few attracted as much attention as a complete, pre-fabricated toilet installation for trains, and shown by the Dutch Werkspoor N.V. A German firm showed panels of sandwich construction that were made of glass-polyester resin and rigid polystyrene foam and are designed for interior and exterior use in buildings. Nylon products for use in roads, pipe fittings, and railway fish-plates were shown. Epoxy resins for numerous applications were shown by Ciba. The Dutch firm, N.V. Metaalwaren en Kunststoffenfabriek "Mekufa" used this resin for high-tension switches, terminals for cables, and in an insulator for 1,000,000 volts of nuclear energy. The German firm, Hoechst, featured among many specialties polyethylene screening for decorative and utilitarian purposes, that was said to be produced by a method similar to that used for making expanded metal.

In the machinery section, the center of attraction was the new extrusion equipment produced by Battenfeld, of Germany. A feature of these machines is that the screw can be adjusted axially. A complete sheet-extrusion installation, with screw of 90-millimeter diameter, drew particular attention. It can be used with all thermoplastics; is almost completely automatic; and includes a special slit die that can be kept hydraulically to the required gage; take-off rolls; cut-off; and automatic stacking unit. The company also had on view a new bottle-blowing machine developed from a vertical injection molder. The manufacturer of extruders, it may be mentioned is a new line for Battenfeld, which has concentrated hitherto on injection molding equipment. This expansion of activities is given as the reason why the German company, together with its Dutch agents, have formed a new, separate sales organization for Holland named Battenfeld Nederland N.V., Amsterdam.

Another German firm, Johan Fischer, also demonstrated new bottle-blowing equipment that aroused a good deal of interest. Much interest also was displayed in a device by Aust & Schuttler, Germany, by which polyester resin, catalyst and glass fiber can be sprayed simultaneously onto a mold.

Of the machinery produced by Dutch manufacturers, high-frequency welding machines by Maxinec N.V. may be noted and, in particular, an arrangement for the wholly automatic and continuous vacuum-forming of small plastic containers and then filling and sealing them. N.V. Nautamix seems to be having much success with its high-speed mixers with capacities of two and 20 liters, respectively, for laboratory and pilot-plant use. A high degree of mixing precision (to 0.01%) and very low power consumption are claimed for these units.

Bulk Polymerization

Saint Gobain Chauny & Cirey, Paris, France, is said to be the only manufacturer of PVC to produce the material on a commercial scale by bulk polymerization. It is learned that the West German firm, Wacker Chemie A.G., of Munich, has obtained a license to produce PVC by this method, and that certain American manufacturers have also negotiated with Saint Gobain.

Joint German-French Effort

The Farbwerke Hoechst A.G. and the French Société Centrale de Dynamite (Nobel-Française) have jointly established a new firm, Polysynthese S.A., in France for the production of polyvinyl acetate dispersions, in addition to other chemical and pharmaceutical products. Nobel Française and Hoechst, together with the latter's French agency, Peralta S.A., have each contributed 50% of the capital for the new company.

New Spanish Company

Poliesteres, S.A., Madrid, is a new Spanish company recently formed by the Union Quimica del Norte de Espana S.A. and the Union Espanola de Explosivos S.A., to produce and sell chemical products in general, and polyester resins in particular. The French firm, Saint Gobain Chauny et Cirey, S.A., of Paris, also has an interest in this enterprise.

New Materials

Write item numbers on Readers' Service Card to obtain more information.

Flame-Resistant Adhesive

A flame-resistant, flocking adhesive for display and decorative uses has been introduced by Adhesive Products Corp. Called Flok-Grip, the material can be used to adhere such materials as cotton, wood, or synthetic fiber flock; glitter and flitter; plastic, glass, wood, or foam beads; plastic petals; confetti; and various other materials to such varied bases as natural wood branches, leaves, evergreens, artificial flowers, and plaster ornaments.

In addition to a good bond, Flok-Grip is self-extinguishing. A water-based product, it can be applied by dipping, brush, or spray. It is both white and translucent, and dries without staining. The adhesive is flexible when dry, a feature which does not deteriorate with age. It can be colored, if desired, to blend with the decoration. Other features include quick grab and rapidity of drying.

Readers' Service Item M-1

Water-Dispersible PVA Powder

A powdered form of polyvinyl acetate, readily re-dispersible in water, has been introduced on the market by Colton Chemical Co. Called Vinac RP-250 Powder, the material is designed for usage where a high percentage of water cannot be tolerated in a finished product or to increase the solids content of a formulation. It is used also in dry blends.

RP-250 mixes readily with water to a solids content of 65% before the emulsion becomes too viscous to be workable. A typical viscosity for a 50% dispersion in distilled water is approximately 1,300-1,400 cps. at 77° F. This was determined with a #3 spindle at 60 rpms. with a RVO Brookfield viscometer.

Tentative specifications follow:

Appearance	Fluffy white power
pH	4-6
Free monomer content	Negligible
Odor	Negligible
Mean particle size of powder, microns	1-3
Mean particle size of powder, microns	3-5
Bulk density, gm./cc	0.53

Readers' Service Item M-2

Polyester Foam-Resin Line

Two, low-cost polyester foaming resins and a prepolymer have been added to Pittsburgh Plate Glass Co.'s Selectrofoam line. Features and properties of each are listed in the following paragraphs.

Selectrofoam Resin 6207 is a polyester for forming flexible foams which are characterized by excellent load-carrying capacity at low densities, high resilience, good freeze resistance, and very low compression set. Simple recipe changes provide suede-soft to stiffer materials, foamed batchwise or in a continuous foam-making machine. Specifications are reported as follows:

Hydroxyl number	57-65
Acid number	3
Viscosity, cps.	20,000-30,000
Water content, %	0.15
Color, Gardner	11-14
Weight, lbs./gal.	8.2-8.4

One suggested formula includes the following: 100 parts by weight of resin, 2.7 parts water, 1.4 parts triethylamine, 10 parts Flexol 10-10, and 36 parts toluene diisocyanate. The first four are stirred together to form a masterbatch to which the toluene diisocyanate is added. In continuous mixing equipment, masterbatch and diisocyanate are pumped in separate lines to a common mixing head for final blending. This foaming mixture is collected in a mold and allowed to expand freely. Foam is cured at room temperature for 10-15 minutes, stripped from the mold, and crushed several times.

Final cure may be several days at room temperature, overnight at 160° F., one hour at 220° F., or two hours at 180° F. and 95% relative humidity. The following physical properties can be expected in the finished foam:

Density, lbs./cu. ft.	1.95
Compression set, Method B, unaged, %	7.5
Aged, Autoclave SPI, %	7.5
Resilience	44
Tensile strength, psi	15
Pandux	0
Elongation, %	240
90% compression set, 24 hrs., aged & unaged, %	7.2
After 30 minutes,	10.5
Compression-deflection, 2 lb. density, psi:	
15% deflection	0.2
30% deflection	0.29
45% deflection	0.41
60% deflection	0.71
75% deflection	2
Freeze resistance	Good
RMA compression value, 2.2 lb. density, 25%, lbs.	15

Selectrofoam 6004 resin and Selectrofoam 6005 prepolymer provide a system which gives tough, rigid foamed structures. Advantages are quoted as follows: easier blending and mixing due to their low viscosities; low water absorption (closed cell construction); high cohesive strength; toughness and on-friability at low densities; resistance to heat; reduced toxicity, rapid, controllable curing; wide density range; and excellent shelf stability.

For batchwise or continuous machine mixing, a masterbatch blend is made first. This has a stability of several weeks. The masterbatch and Selectrofoam 6005 are blended and agitated for 20 seconds, then poured. Foam expansion is complete within 2-3 minutes.

Specifications are reported as follows:

	Selectrofoam 6004	Selectrofoam 6005
Viscosity, Brookfield, cps	28,000	1,500
Hydroxyl number	370	——
Acid number	1	——
Water content, %	0.1	——
Color, Gardner-Holdt	5	2
Weight, lbs./gal.	9.7	10.5
Equivalent weight per NCO group	——	130

The following table gives typical formulations to provide various densities:

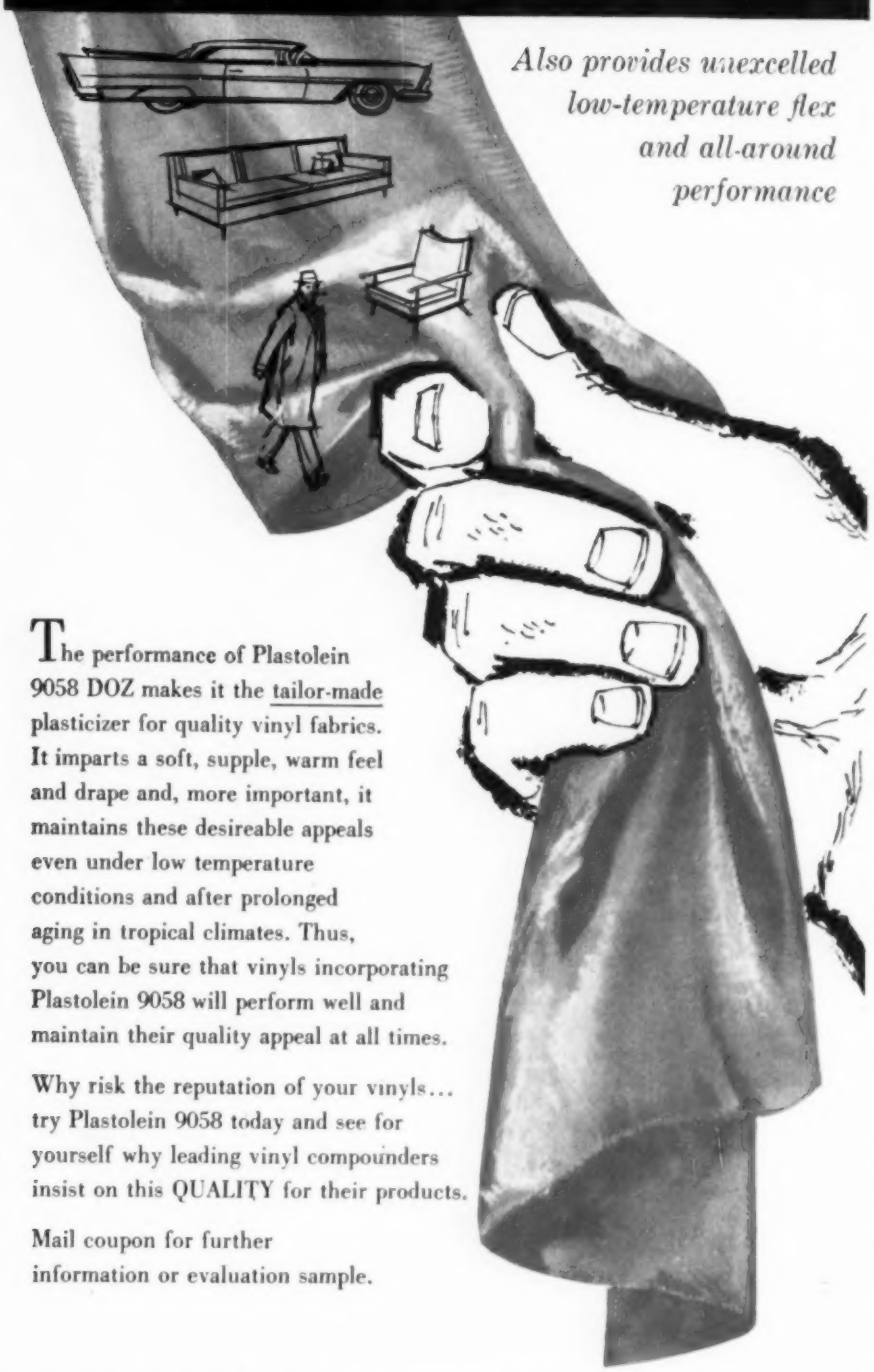
Density, open expansion, lbs./cu. ft.	1.6	2	3.3	6.4	9.5	15	2.6	2
Formulation:								
Selectrofoam 6004, parts	60	70	80	80	80	80	75	70
Water	3.5	2.7	1.7	0.7	0.4	0.2	0.83	1.3
Selectrofoam 6915	0.5	0.5	0.5	0.4	0.4	0.3	0.5	0.5
N-methyl morpholine	0.8	0.9	1.0	1.0	1.0	1.0	—	—
Selectrofoam 6914 catalyst	—	—	—	—	—	—	3.0	3.0
Selectrofoam 6005	100	100	100	100	100	100	100	100
Properties:								
Water absorption, 1 mo., %	3	3	3	3	3	3	3	3
Deformation temperature, °F.	210	210	210	220	250	250	210	210
Compressive strength, 25% comp., psi	23	25	56	150	210	1,000	30	23
K factor, Btu./hr./sq. ft./°F./in.	0.23	0.24	0.25	0.28	0.31	0.35	0.24	0.24

Readers' Service Item M-3

The Superior Drape and "Hand" imparted by

PLASTOLEIN 9058 DOZ

stamps "QUALITY" on vinyl fabrics!



Also provides unexcelled low-temperature flex and all-around performance

The performance of Plastolein 9058 DOZ makes it the tailor-made plasticizer for quality vinyl fabrics. It imparts a soft, supple, warm feel and drape and, more important, it maintains these desireable appeals even under low temperature conditions and after prolonged aging in tropical climates. Thus, you can be sure that vinyls incorporating Plastolein 9058 will perform well and maintain their quality appeal at all times.

Why risk the reputation of your vinyls... try Plastolein 9058 today and see for yourself why leading vinyl compounders insist on this QUALITY for their products.

Mail coupon for further information or evaluation sample.

Organic Chemical Sales Department

Emery

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Carew Tower, Cincinnati 2, Ohio

Emery Industries, Inc.
Dept. Q4, Carew Tower
Cincinnati 2, Ohio

☐ Send me bulletin on Plastolein Plasticizers
☐ Send me 1 pint sample of Plastolein 9058 DOZ
☐ Send a technical representative

Clip this coupon to your letterhead, sign name and title, and mail today.

Vinyl Plasticizer-Stabilizer

A technical grade of tributyl aconitate in liquid form has been introduced by Chas. Pfizer & Co., Inc. Early test results indicate its usefulness as a low-temperature plasticizer for styrene-butadiene copolymers, as a heat and light stabilizer for vinylidenes, as a primary plasticizer for vinyl chloride-acetate copolymers such as Vinylite VYNW, and as a secondary plasticizer and stabilizer in DOP-plasticized PVC systems. It has been used also with cellulose acetate and nitrocellulose lacquers.

Typical physical properties are reported as follows:

Form	Liquid
Content, tributyl aconite, %	75-80
Acetyl tributyl citrate, %	20-25
Specific gravity	1.0235
Refractive index	1.4511
Color, Hazen	<50

Readers' Service Item M-4

High-Density Polyethylenes

Six, numerically-designated, high-density polyethylenes have been placed on the market by Bakelite Co. Produced by the Ziegler method at Union Carbide's Institute, W. Va. plant, the materials are tailored to the following processing techniques: injection molding, extrusion, extrusion coating, monofilament extrusion, blow molding, and contour extrusion.

DMDA-6001 and DMDA-6201 were developed specifically for injection molding, the latter differing from the former in that it has a higher melt index and easier flow characteristics. Although field tests have shown it to have less strength and lower resistance to stress cracking than 6001, it is nevertheless recommended for non-critical applications where multiple cavities require a fast flow. Typical properties of both materials are listed in the following table:

	DMDA-6001	*DMDA-6201*
Specific gravity (density)	0.95	0.95
Melt index	1.5-.5	7.5-8.5
Properties in direction of flow:		
Ultimate tensile strength, psi	2,900-4,000	3,500
Ultimate tensile elongation, %	30-90	55
Yield strength, psi	2,700-3,700	—
Secant modulus, psi, x 10-3	83-108	107
Tensile impact strength, ft.lb./cu.in.	25-130	65
Impact strength, Izod, ft.lb./in. notch	0.4-3.0	1.0
Properties across lines of flow:		
Ultimate tensile strength, psi	3,000-3,700	3,500
Ultimate tensile elongation, %	9-60	30
Yield strength, psi	3,000-3,000	—
Secant modulus, psi	95-140	104
Tensile impact strength, ft.lb./cu.in.	20-60	50
Impact strength, Izod, ft.lb./in. notch	0.4-0.7	0.6
Durometer hardness	63	
Minimum gloss temp., °F	500	450
Skin temp., °F	650	450

DGDB-4002 is adapted to either tubular or flat film extrusion. Due to its higher softening point, a moderate increase of about 15° C. in compound temperature is required to produce the tubular material. Cooling of tubular film is best accomplished with a mandrel; flat film by a chill roll or water bath.

Major competitive advantage of 4002, according to Bakelite sources, is its ability

to be extruded into thinner gages without surging problems. Haze, gloss, and see-through qualities meet most visibility requirements. Typical properties of 1½-mil film, both tubular and flat, are listed below:

	Tubular	*Flat*
Density	0.95	0.95
Stiffness, Handle-o-meter, gm., M.D.	39	66
T.D.	32	56
Tear resistance, gm./mil, M.D.	10	15
Coefficient of friction	0.23	0.41
Moisture vapor transmission, g.-in/day/M²	0.005	0.007
Oxygen permeability, cc./100sq. in./24hrs.	90	110
Haze, %	20	11
Gloss x 10³	80	115
See-through, ft.	60	60

DGDA-4551 was developed specifically for extrusion coating on paper substrates, and is said to offer excellent barrier and handling properties. Extrudability is outstanding, and the material is harder, stiffer, and has a lower coefficient of friction than the conventional low-density polyethylenes. Other reported features include superior through-put speeds, minimum coating thickness, good drawdown, and minimum surging.

DMDA-4901 is marketed primarily as a blow molding compound; however, it is also recommended for the extrusion of monofilaments, for contour extrusion, and the extrusion of sheets for vacuum forming operations. In both of the latter instances, extruders should add their own anti-oxidant.

Physical properties of articles blow-molded from 4901 are dependent upon both the material and the conditions under which the articles are molded. Inherent physical properties, obtained on compression-molded plaques are reported as follows:

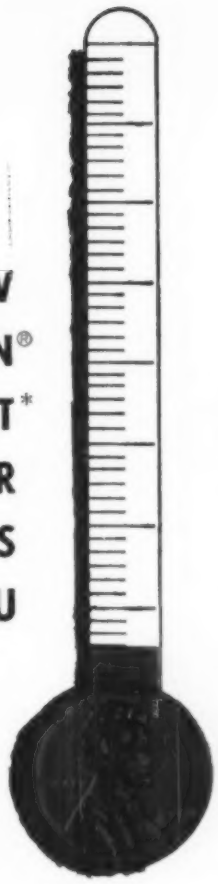
Liquid permeability factors, gm./1 mil/24hrs./100 sq.in.	
Acetone	0.83
Ethyl acetate	2.83
Lemon oil	11.93
Melt index, dgm./min.	0.3-0.5
Density	0.95
Hardness, Durometer D	60
Tensile strength, psi	3,300
Elongation, %	50
Secant modulus at 1% elongation, psi.	90,000
Brittle temperature @ 20% failure, °C	-97
Specular light transmission, %	0.3
Gas permeability, cc./mil/100 sq.in./hrs.	
Dry carbon dioxide	349
Dry oxygen	98

DGDB-4100 was compounded specifically for the extrusion of monofilaments and sheeting. It contains an anti-oxidant for higher heat resistance, and finds monofilament application primarily in garden furniture tape where it has twice the tensile strength of previously-used materials. Since the extrusion temperatures required for it and for 4901 run slightly higher than for conventional polyethylenes, a high temperature head should be installed on the older, short-barrel extruders.

Contour applications for 4100 include radiator over-flow hoses, vacuum lines, and gas lines. Low-temperature impact strength and chemical resistance make it and 4901 particularly suitable for freezer and refrigerator housings, and for the packaging of frozen food.

Readers' Service Item M-5

NEW PLASTOLEIN® 9078 LT* PLASTICIZER GIVES YOU



low-temperature flex and low cost!

Properties superior to adipates, yet in same price range

New Plastolein 9078 LT Plasticizer possesses an outstanding combination of properties that makes it very attractive as an economical low-temperature plasticizer. A unique product derived from Emery's Ozone Oxidation Process, Plastolein 9078 offers many advantages over the adipates, including better low-temperature flex, volatility, increased compatibility, lower mineral oil extraction, and higher efficiency.

If you are now using an adipate, check the advantages that Plastolein 9078 can impart to your product. Mail coupon below for descriptive literature, an evaluation sample, or a visit from one of our technical representatives.

*Low temperature

Comparison of Plastolein 9078 with di-decyl adipate

Plastolein 9078		DDA	Plastolein 9078		DDA
Parts Geon 101	100	100			Borderline
Parts Plasticizer	48	49	Masland Impact, °C	—40	at —40
Tensile, psi	2650	2400	Extraction, mg/in²		
Elongation, %	365	360	Water, 24 hrs. @ 50° C	0.2	0.1
Modulus, 100%, psi	1130	1240	Soapy Water, 24 hrs. @ 50° C	1.0	0.4
Hardness, D.10 sec.	85	89	Min. Oil, 24 hrs. @ 25° C	11.1	19.8
Volatility, SPI, 70° C			Compatability, Roll		
1 day-mg/in²	1.9	2.3	Spew	Slight	Severe
7 days-mg/in²	8.0	9.1			

Organic Chemical Sales Department
Emery
Emery Industries, Inc. Carew Tower
Cincinnati 2, Ohio

Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio. Dept. Q4A

- ☐ Please send descriptive literature on Plastolein 9078
- ☐ Please send a pint evaluation sample
- ☐ Please send a technical representative

name.....*title*.....
company.....
address.....
city.....*state*.....

New Equipment

Write item numbers on Readers' Service Card to obtain more information.

Thermomat's hopper-type preheater and dryer.

Combination Pre-Heater Dryer

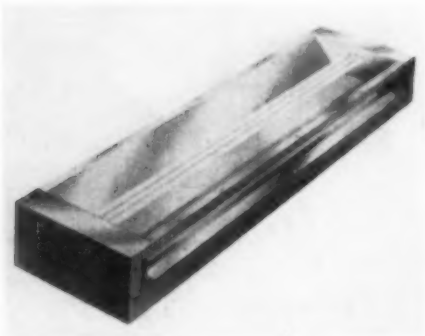
Designed for fabricators using one or more manually loaded injection molding machines or extruders, a combination hopper-type preheater and dryer is available from Thermomat Co., Inc. Made in two sizes with bin capacities of five or 10 cubic feet, the electrically heated unit delivers a uniformly conditioned product and is fitted with a gate valve for quick bucketing from hopper to machine. The smaller models occupy a floor space of 24 by 24 inches, while the larger ones require a space of 30 by 30 inches.

When used with exceptionally moisture-sensitive materials such as nylon, the preheater-dryer can be fitted with the company's Deumatic unit which fits into the cabinet and requires no extra space. The insulated bin has a large opening at the top that is covered with a lid-type door. It is fitted with a low-cost replaceable filter, and a large viewing glass or low-level signal.

The entire assembly is mounted on rubber casters; features quiet operation; and is reported to occupy less floor-space than ovens of equivalent capacity. Both the heater and the Deumatic units are available singly, dually, or in combination with the preheater drier, specifications for which are as follows:

Model No.	Heater Cap. kw.	Hp.	Deumatic Hp.
H5	2.0	1/3	—
HD5	2.0	1/3	1/8
H10	5.0	1/2	—
HD10	5.0	1/2	1/4
Heater only	2.0	1/3	—
Heater and Deumatic unit	2.0	1/3	1/8

Readers' Service Item E-1



Fostoria's triple socket, infra-red oven section.

Infra-red Oven Sections

Infra-red oven sections, accommodating three different types of linear heat sources, are now available from Fostoria Pressed Steel Corp. Designated the 51-000 and 52-000 series, these sections can be equipped with quartz tubes or metal rods for far infra-red radiation at 1,400-1,800° F., or with quartz lamps, operating at filament temperatures of 4,000° F., for near infra-red.

Reflectors are available in specular gold or aluminized steel; the latter being recommended for use where high dust concentrations in the air are prevalent. The reflectors are optically designed to distribute an even heat pattern over the entire product. A secondary reflector, positioned in back of the primary reflector, serves to redirect heat forward, and acts as an insulating barrier to provide a channel for forced air flow when cooling is necessary.

Socket design is such that up to three heat sources can be accommodated. Terminal wires can be inserted into the sockets and secured from the front of the section. Wiring is located behind the secondary reflector away from excessive heat, and all electrical components are covered to provide a streamlined appearance and protection against high temperatures.

Sections for both series are identical in dimensions. They are available in widths of 5½-inches for accommodating one or two heat sources, and in widths of 11-inches when up to three heat sources are needed. Both types are available in lengths of 16, 22, 31, and 44-inches. The sections are bolted together to provide various oven patterns that give optimum heat application to irregularly shaped pieces. Electrical controls permit a wide selection of heat intensities, and an open-end design allows the addition of more sections when production requirements call for it.

Readers' Service Item E-2

Right-angle, spring-loaded thermocouple.

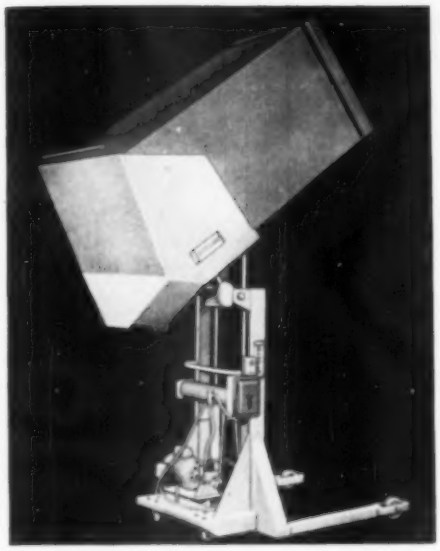
Spring-loaded Thermocouple

Accurate temperature measurement of items that expand or displace during operation, such as the internal surface of extruders or generator bearings, is reportedly obtainable with a spring-loaded thermocouple (Type J) recently introduced by Minneapolis-Honeywell Regulator Co.'s industrial division. Made of Iconel-X, the thermocouple's spring holds it firmly against the work surface, thus assuring constant contact and accurate measurement. It permits installation in holes varying up to ±5/16-inch from the specified depth, and withstands temperatures to 900° F.

The thermocouple is available in either straight or 90° angle construction. A bayonet adapter fits it to a ⅛-in N.P.T. pipe connection, and the assembly itself is fitted with a corresponding cap to engage the adapter. Both angle and straight types come with 3/16-inch O.D. 304 stainless steel protecting tubes and 5/16-inch extensions of flexible armored tubing in lengths of 1-10 feet as specified. If desired, a ½-inch junction box connector can be mounted at the end of the armored tubing.

Other specifications are as follows: calibration, Iron-Constantan (Type J); wire gage, No. 20; and hole depth, ½-18 inches in ¼-inch increments. Tangs to fit a No. 8 machine screw, soldered on ends of thermocouple wires, are optional.

Readers' Service Item E-3



Tubar dumper in delivery position.

Dumper for Bulk Chemicals

A dumper, specially designed for emptying bulk chemical containers, has been introduced by the Tubar Dumper division of Uhrden, Inc. Called the Tubar Twin Cylinder Dumper, it elevates loads up to 4,000 pounds to heights of 60 inches. These loads can be stopped and held at any point in the dumping cycle.

The individual customer can specify several features on the standard model: the receiving carriage is furnished with forks or platform; the unit is available for fixed installation or portable; carriage and hood dimensions are to customer specification; hood and chute can be aluminum or stainless steel; and the motor can be totally-enclosed electric or air hydraulic.

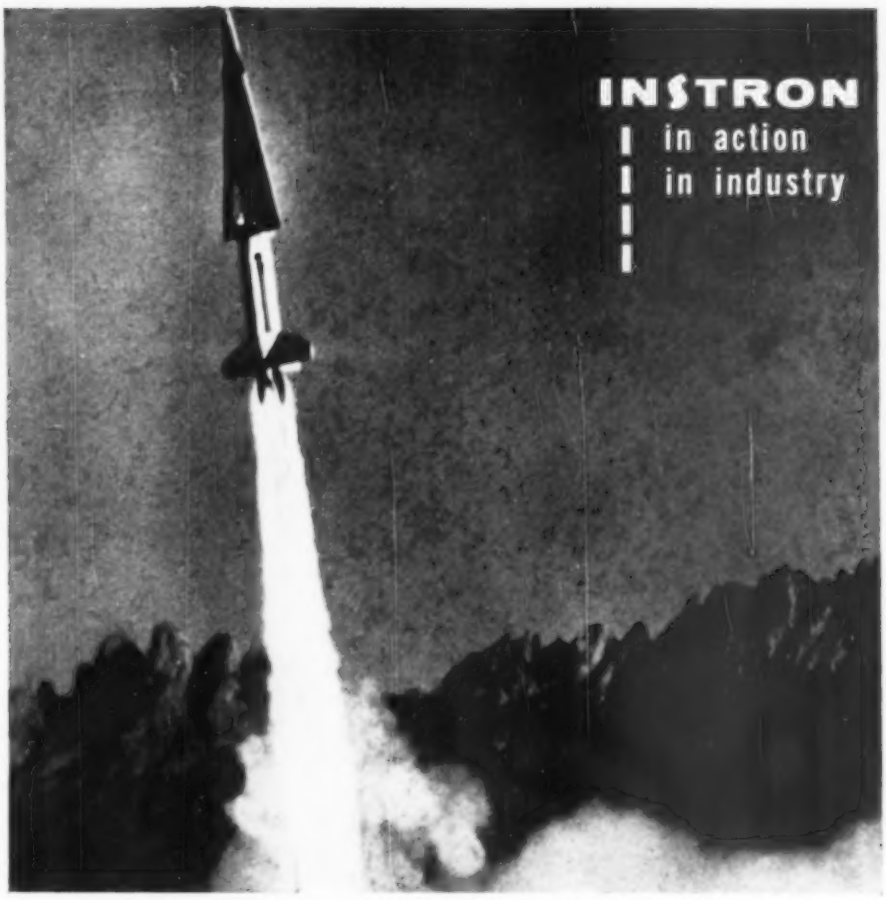
Dimensions of the unit are as follows: width, 46 inches; length, 60½ inches; and height, 87 inches. Weight is approximately 500 pounds, and control is by manual push-button.

Readers' Service Item E-4

Electrostatic Separator

A laboratory-model, high-tension, electrostatic separator that can separate metal particles, paper, and string from plastics, and even separate polystyrene from cellulose acetate (although not perfectly, as yet), has been developed by Carpco Mfg., Inc. When used in laboratories, the unit will show separations that are possible, and the efficiencies that can be expected. As such, the unit can be used also as a control for industrial plants.

Electrostatic separations utilize a difference in the surface charges of different materials to affect a separation. Even differences in shape and texture of particles may provide enough difference in the rate that electrons are collected or discharged to permit separation. The unit, Model ES16, permits separations up to a feed rate of approximately 150 pounds



This is the U.S. Army surface-to-air Nike-Hercules Missile which incorporates a solid propellant sustainer unit developed and produced by Thiokol Chemical Corporation.

How Thiokol uses the Instron Tester

Solid propellant rocket engines, developed and produced by Thiokol Chemical Corporation, are the power plants that put the "go" into many of our guided missiles.

The solid propellant that powers these engines must be resilient enough to withstand extreme temperatures and very rough handling. Thus, numerous tensile tests are required to determine how each propellant formulation will perform in a rocket engine.

In performing these critical tests, Thiokol relies on the electronic accuracy of the **Instron Universal Testing Machine.**

Thiokol is another in the long list of leading companies in many different fields who count on Instrons to perform universal testing and measuring functions, including tension, compression, hysteresis and elastic modulus . . . *on materials ranging from acetate to zirconium.*

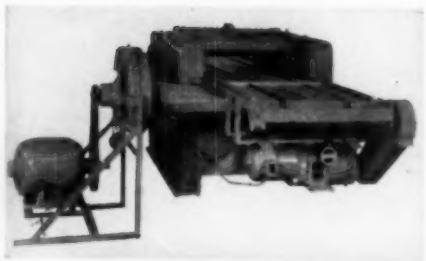
Tensile testing solid propellants at elevated temperatures. Lever mechanism shown here accelerates rate of strain achieved by Instron's electronically controlled crosshead. Note that jaws grasp dumbbell-shaped sample at edges to reduce possibility of propellant failure at other than its minimum cross section.

For facts booklet, write:

INSTRON
ENGINEERING CORPORATION
2501 Washington Street, Canton, Mass.

per hour. The specimen mixture is placed in the feed hopper and fed into the feed rotor. The products gained may be caught in pans for visual inspection of the degree of separation and, if necessary, returned to the hopper for further processing. Rotor speed is controlled by a variable voltage transformer, and the electrical discharge pattern may be controlled and varied during the process.

Readers' Service Item E-5



Buss Machine Works' hi-speed plastics planer.

High-Speed Plastics Sizer

A sizing machine designed for high-speed tolerance planing of plastic blocks, sheets, squares, and laminates has been introduced by Buss Machine Works. Called the Micro-Surfacer, the machine operates at considerably higher feed-rates per pass than were previously available.

Stock is fed through the machine by means of drag chains and pusher rails. On entry, it is held down by pressure rolls and shoes while a six-knife cutterhead with tungsten-carbide blades cuts the top surface to the desired gage. This cutterhead operates at speeds up to 5,000 rpm., which allows machining of thermoplastics without melting them. The gage of cut is determined by the power setting, which raises and lowers the bed through two machined- and hand-scraped wedges. Fine settings are obtained by dial handwheels graduated in mils.

The Micro-Surfacer is available with variations to plane sheets from 24 to 56 inches wide. The Rockwood V-belt drive affords up to 50 hp. for the cutterhead, thus allowing ¼-inch cuts to be taken with ease. Sheeting 54 inches wide by eight inches thick can be run through the machine at speeds upwards of 300 feet per minute. In the case of very thin stock, the drag chain slats are replaced by conveyor and roll feed. Other variations of the machine are available to customer specification.

Readers' Service Item E-6

Vital ingredients for the PLASTICS INDUSTRY

METASAP VINYL STABILIZERS

—designed to give better protection from heat and light. Whether you are producing film, sheeting, floor tile or plastisols, there is a Metasap Stabilizer to do the job.

METASAP METALLIC SOAPS

—these proven compounds not only improve internal lubrication of mold powders, but act as plasticizers. When dusted on molds, they supply external lubrication and prevent sticking. They also permit molding at lower pressures, help speed the molding cycle, promote longer mold life, improve the finish of the end product.

Our skill in the manufacture of these compounds is complemented by our nationwide distribution facilities.

So remember, whatever your needs, you will fill them best—fill them fast—through Metasap. Write for full information. Our Technical Service Department will gladly make recommendations based upon your specific requests. Metasap Chemical Company, Harrison, N.J.

METASAP CHEMICAL COMPANY

VITAL INGREDIENTS FOR THE PLASTICS INDUSTRY

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Allen bench type punch press, model B-3

Three-Ton Punch Press

A three-ton, bench type punch that can be adapted for any standard punching operations within its rated capacity has been placed on the market by Alva Allen Industries. Called the Model B-3, this machine can punch, shear, form, blank, draw, and cut materials such as plastics, metals, leather, fiber, textiles, and paper.

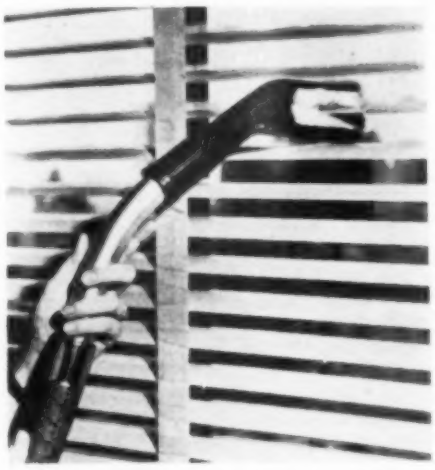
In continuous operation, Model B-3 will mass-produce articles at rates up to 300 per minute. It has a rugged, durable construction, and is provided with a single pin, quick action clutch with a positive-repeat or non-repeat action. Straight ram guides give accurate fitting of dies for precision operations, and the ram adjustment is provided with a positive lock. While the standard stroke length is one-inch, special lengths can be obtained from ¼-1½ inches. This model is recommended for many production and experimental operations not requiring heavier presses, and is available in the following dimensions:

Crankshaft dia. at main bearing, in	1
Die bed, width, in	6.25
depth, in	8
distance between holes, in	7
Ram face, in	1.75 x 3.5
Punch chuck hole, dia., in	1
Distance from ram to bed, in	5.75
Shut height, in	4.75
Ram adj., in	0.75
Bed opening, in	2 x 3.5
Throat depth, in	3.25
Width between uprights, in	3.5
Over-all height, in	20.25
Base size, width, in	8.25
depth, in	9
Recommended hp	0.333
Weight of press, lbs	123
Shipping weight, lbs	143

Readers' Service Item E-7

Plastics Applications

Write item numbers on Readers' Service Card to obtain more information.



V-Vac attachment for cleaning venetian blinds.

Vacuum Attachment For Blinds

Venetian blinds are cleaned easily and neatly with a unique vacuum cleaner attachment, the V-Vac, currently available from the W & W Mfg. Co. It consists of a durable plastic tube and double set of Dynel dusters, which slips easily over the hose of almost any popular vacuum cleaner.

Dynel, Union Carbide's acrylic fiber, was the material of choice for the dusting material. Dust is removed by the soft, deep-pile Dynel and is drawn down through the hose without scattering. The dusters run over and under each slat simultaneously, thus cutting the work in half. Each of the four dusters is easily removed for cleaning, and is unaffected by soap or detergents. They are fast drying and will not lose their fluffiness. Dynel dusters last longer than other types, according to the manufacturer, and are inexpensive and easily replaced.

Readers' Service Item P-1

Reinforced Plastic Statuary

In a new approach to religious statuary, Testaguzza Bros. & Co., Inc., fabricated a 10-foot statue of Christ for the exterior of Holy Name Church in Birmingham, Mich. Gleaming white, the figure is said to combine both appearance and weatherability. It gives the appearance of solidity, yet weighs but 100 pounds.

Testaguzza Bros. based the molding job on a plaster cast, laying up by hand a ¼-inch thick, 22-piece mold of glass fiber-hardened polyester resin. When the mold was cured, the figure was taken apart piece by piece; then reassembled to produce the finished product. Polyester resins used for this application were Plaskons, a product of Allied Chemical & Dye Corp.'s Barrett division.

Reinforced plastic statue of Christ.

Readers' Service Item P-2

Butyrate Telephone Amplifier

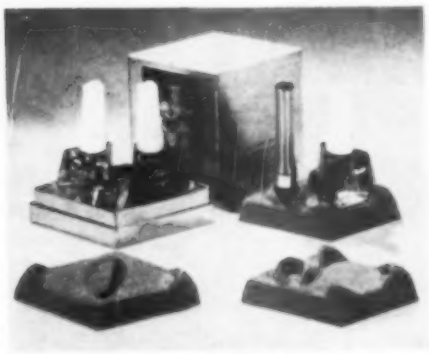
A portable telephone amplifier which is said to increase acoustic output by 49 decibels has been placed on the market by the Remler Co. Called the Scottie Phone Aid, the device consists of a battery-operated reproducing receiver and a three-stage amplifier enclosed in a black Tenite butyrate case.

The use of printed circuits and the transistor amplifier enabled Remler to hold the weight of the entire device down to three ounces. A boon to the hard of hearing, Scottie is also useful in noisy locations or for improving rural and long distance connections. It picks up speech by magnetic induction, and a circuit device shuts out disturbances created by electrical circuits and appliances.

No "warm up" is necessary. Scottie is clipped to the telephone with one hand, and volume control allows fingertip adjustment to the desired level of audibility. It shuts off automatically when removed, and the volume control switch eliminates battery drain when the phone aid remains attached to the receiver.

Butyrate-housed telephone amplifier.

Readers' Service Item P-3



Pre-flocked Styron forms nail polish platform.

Styron Nail-Polish Package

Pre-flocked Styron 480 sheet is vacuum-formed by Emet Plastics Corp., into platforms for the nail polish produced by Juliet Marglin, Inc. These platforms have undercut prongs which hold the bottles firmly in place during shipping, and their flocked surfaces afford an attractive setting for the product.

Vacuum forming permits the use of inexpensive plastic molds to achieve a production rate of 4,200 platforms per hour. Molds can be removed quickly following a run, and held for future use. Emet uses an Emhart Model 50-30 Vac-Form for the operation. This machine has a speed of 60 cycles per hour with a 70-cavity mold.

Readers' Service Item P-4

One-piece molded polyethylene laundry basket.

Polyethylene Laundry Basket

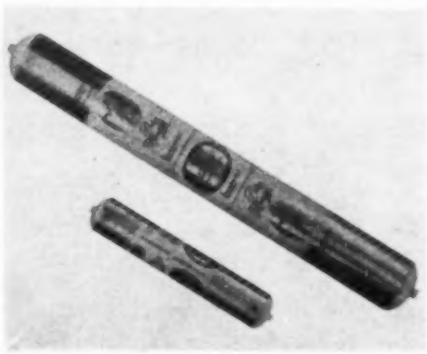
A rectangular laundry basket, molded from polyethylene and designed to fit modern laundry carts, has been introduced by Federal Tool Corp. It has a drip-free solid bottom, and snag-free handles. Dimensions are reported as follows: width, 16½ inches; length, 22½ inches; and depth 12 inches. The basket weighs but eight pounds, and is available in red, yellow, pink, and turquoise.

Readers' Service Item P-5

Printed Saran Film Wrap

Another specialized wrapping for the meat packing industry has been developed by Printon Corp., for use by Koninklijke Vleeswarenfabrieken, a Dutch concern. The packaging is called Saran-O-Lam, and involves a special process developed by Printon using Dow Saran film.

The particular package depicted below is a liverwurst casing, which is rotogravure-printed in white, blue, and metallic gold. Printing is done on one side of the film, and laminated with a special adhesive to a clear Saran film. This affords double-strength protection to the meat, while providing point-of-sale suggestive merchandising.



Laminated Saran liverwurst wrap.

Readers' Service Item P-6

Pitcher and tray molded from C-11.

Modified Styrene Pitcher

An insulated serving pitcher molded from Bakelite's C-11 modified styrene is available from N.F.C. Engineering Co. Called the Thermo Serv beverage server, it holds a quart yet is amazingly light in weight. Low thermal conductivity through the molded walls keeps the movement of heat in or out at a minimum.

C-11's toughness virtually eliminates marring of the glossy surface. The hinged stopper can be removed entirely for adding ice cubes, and a wide lip simplifies pouring. Five color combinations are available: coppertone, silvertone, brasstone, pastel green, and pastel yellow; each combined with a jet black base, handle, and pouring lip.

Readers' Service Item P-7

★ Quality POLYVINYL CHLORIDE resins in a complete range of molecular weights . . . heat and light stable, excellent blending characteristics, low "gel" count, clean and free of contamination!

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Weather-proof glass-polyester mailbox.

Reinforced Plastic Mailbox

A king-sized mailbox combining attractive appearance with resistance to weather and rusting is available from Plastic Products Corp. Called the Town and Country, the box is molded of glass-reinforced

Plaskon polyester resins supplied by Allied Chemical & Dye Corp.'s Barrett division.
Reader's Service Item P-8

Plastimayd's two-piece vinyl Aqua-Suit.

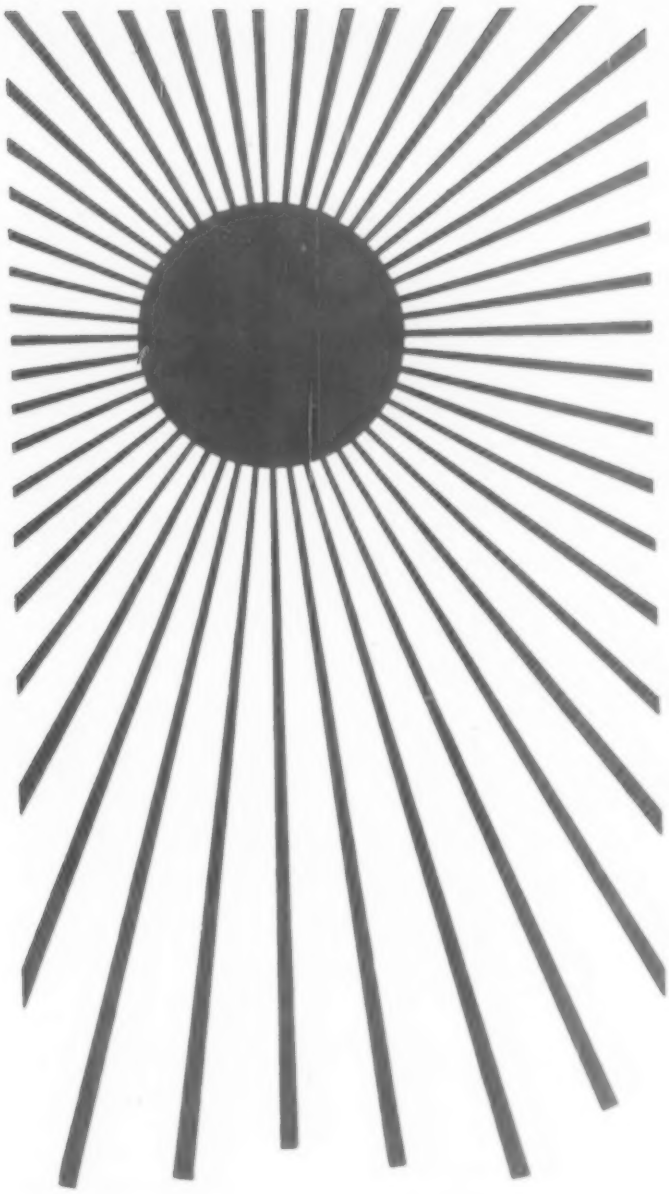
Two-Piece Vinyl Aqua-Suits

A lightweight, two-piece Aqua-Suit which should enable water skiers to extend the season has been introduced by Plastimayd Products Corp. Fabricated from Bakelite's Krene flexible vinyl, the suit's bright yellow color serves as a marker for the pick-up boat or other craft. The jacket has an adjustable elastic neck and waist, and wrists can be left open or closed. Aqua pants are available in regular and deluxe styles, the latter featuring waterproof stocking-type feet.
Readers' Service Item P-9

Polyethylene mat protects carpeting.

Ribbed Polyethylene Matting

Ribbed matting for protecting floors and carpeting in bad weather has been placed on the market by Gering Products, Inc. Called Tidy Mat, the product is extruded from Bakelite's polyethylene in 30-inch wide rolls which are available in lengths of six, 50, and 100 feet.
Reader's Service Item P-10



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New Literature

Write item numbers on Readers' Service card to obtain copies.

"Plastolein 9078 LT Plasticizer." No. 401. Emery Industries, Inc. 3 pages. This bulletin gives tentative specifications, performance data, and results of a Florida aging study of a new low temperature vinyl plasticizer.

Readers' Service Item L-1

"Lamicoid Rigid Laminated Plastics." Mica Insulator Co. 18 pages. Various grades of thermosetting laminated plastic sheets, tubes, and rods, marketed under the Lamicoid tradename, are tabulated and described in this brochure.

Readers' Service Item L-2

"The Case of the Insidious Insulators." Mesa Plastics Co. 8 pages. This brochure explains failures caused by plastic insulator deterioration. Investigations were conducted under conditions of high temperature and humidity.

Readers' Service Item L-3

"Condensed Reference File." Bakelite Co. 10 pages. This illustrated brochure outlines the development of phenolics, vinyls, styrenes, epoxies, and polyethylenes; portraying several applications of each.

Readers' Service Item L-4

"Peracetic Acid and Derivatives." F-40, 108A. This booklet contains a treatise on peracetic acid and reactions of epoxides. It lists properties and possible uses of 12 epoxides now available in research samples.

Readers' Service Item L-5

"Kel-F Plastic Laminate." AD-152. United States Gasket Co. 4 pages. Properties, application methods, and applications for the firm's Kel-F plastic laminates are discussed in this illustrated pamphlet.

Readers' Service Item L-6

"Compounding Study—Plasticizer Evaluation in Pliovic AO Plastisols." Tech Book Facts—Dispersions Compounding 57-205. 11 pages. Primary plasticizers are evaluated for physical properties, heat stability, light stability, low temperature flex, volatility, and miscellaneous characteristics they impart to Pliovic AO. Secondary plasticizers are evaluated for chemical and flame resistance, light and heat stability, and their extendability.

Readers' Service Item L-7

"SM-62 Silicone Emulsion." Bulletin P-11-126-0-2-56. Harwick Standard Chemical Co. 3 pages. This G-E emulsion has a 35% base of methyl silicone fluid in water. It is reportedly suited to mold release applications where maximum stability, release performance, and excellence of finish are desired.

Readers' Service Item L-8

"Cellobond Rubber Reinforcing Resins for Battery Boxes." Tech. Note No. K201. British Resin Products, Ltd. 9 pages. Both materials are phenolic resins, and their properties are listed along with processing instructions.

Readers' Service Item L-9

"Compounding—Volatile Diluents in Pliovic AO Plastisols." Tech Book Facts—Dispersions Compounding 57-19. 2 pages. The effect of diluent on plastisol viscosities is tabulated, recommended thinners are listed, and plastisol viscosity is plotted against diluent content.

Readers' Service Item L-10

"Hydraulic Tables and Other Data." Bulletin 3300. Baldwin-Lima-Hamilton Corp. 40 pages. This bulletin describes and illustrates the Hamilton press line; furnishes conversion tables, decimal equivalents, hydraulic ram capacities, wire and sheet metal gages, steel pipe tables, bolt tables, specific gravities, and strengths of materials; and provides data on fluid losses, properties of metal sections, beam formulas, moments of inertia, deflection curves for springs, temperature conversion tables, and hardness conversion tables.

Readers' Service Item L-11

"Structoglas A." A.I.A. File No. 26-A-9. Structoglas division, International Molded Plastics, Inc. 8 pages. Architects, builders, and plant maintenance engineers should be interested in this catalog on Structoglas A glass fiber-reinforced acrylic-modified polyester panels. Complete information is given on their physical and mechanical properties, chemical resistance, colors, finishes, installation, resistance to exposure, and specifications.

Readers' Service Item L-12

"Metal Coating Organosol." Tech Book Facts—Dispersion Formulations 57-10A. Chemical division, Goodyear Tire & Rubber Co. 2 pages. Formulation of a basic organosol compound based on Pliovic AO is given along with physical properties of resultant films, viscosity data, adhesion, and compounding procedure.

Readers' Service Item L-13

"Cellobond AX. 2621 General Purpose Polyester Resin." Inf. Sheet No. XP109. British Resin Products, Ltd. 11 pages. Properties, compounding information, reinforcement, method of use, catalysts, coloring, and processing information are given.

Readers' Service Item L-14

"How To Control the Sun." Ray-O-Lite Corp. of America. 8 pages. The firm's line of translucent, reinforced plastic awnings are described in this brochure.

Readers' Service Item L-15

"Rotational Molding Plastisol." Tech Book Facts—Dispersions Formulations 57-81. Chemical division, Goodyear Tire & Rubber Co. 2 pages. Pliovics AO and S-70 are blended with DIDA and Flexol CC-55 plasticizers to provide the best viscosity characteristics for rotational molding. Epoxy plasticizer Admex 745 and Advance BC-105 stabilizer combine excellent compound stability with suitable plastisol viscosity.

Readers' Service Item L-16

"Cove Base Formulation." Tech Book Facts—Dry Blend Formulations 57-9. Chemical division, Goodyear Tire & Rubber Co. 1 page. The vinyl formulation is based on Pliovic DB80V. Physical properties and extrusion conditions are listed.

Readers' Service Item L-17

"Pee-Wee Injection Molded Parts." Pee-Wee Molding Corp. 4 pages. The bulletin illustrates tiny nylon bobbins and parts available from the firm.

Readers' Service Item L-18

"General Electric Speed Variator." General Electric Co. 16 pages. This four-color bulletin describes the Variator and explains its features. It is actually an adjustable-speed drive which operates from a-c power, converts same to d-c, and supplies it to a d-c drive motor. This motor's speed is adjustable over a wide range by controlling its armature voltage and field current.

Readers' Service Item L-19

"Flo-Veyor for Transporting Granular Materials." Brady Conveyors Corp. 8 pages. The Flo-Veyor is a pneumatic system for moving dry, pulverized granular material into and out of plants, as well as for unloading hopper bottom cars. Compressed air enters a pressure vessel, creating a fluent aerated mixture of air and solids which moves through the pipe line as a liquid would flow under pressure.

Readers' Service Item L-20

"Geon 121 Paste Resin." Technical Booklet No. G.2. British Geon, Ltd. 20 pages. Compounding and processing information is given, properties are tabulated, and seven graphs are included in this booklet.

Readers' Service Item L-21

"SM-62 Silicone Emulsion." Bulletin P-11-133-0-2-56. Harwick Standard Chemical Co. 4 pages. Properties and applications of this G-E silicone in water emulsion are given in this bulletin.

Readers' Service Item L-22

"SM-61 Silicone Emulsion." Bulletin P-11-150-0-3-56. Harwick Standard Chemical Co. 4 pages. Properties and applications are listed for this G-E emulsion, which is distributed by Harwick.

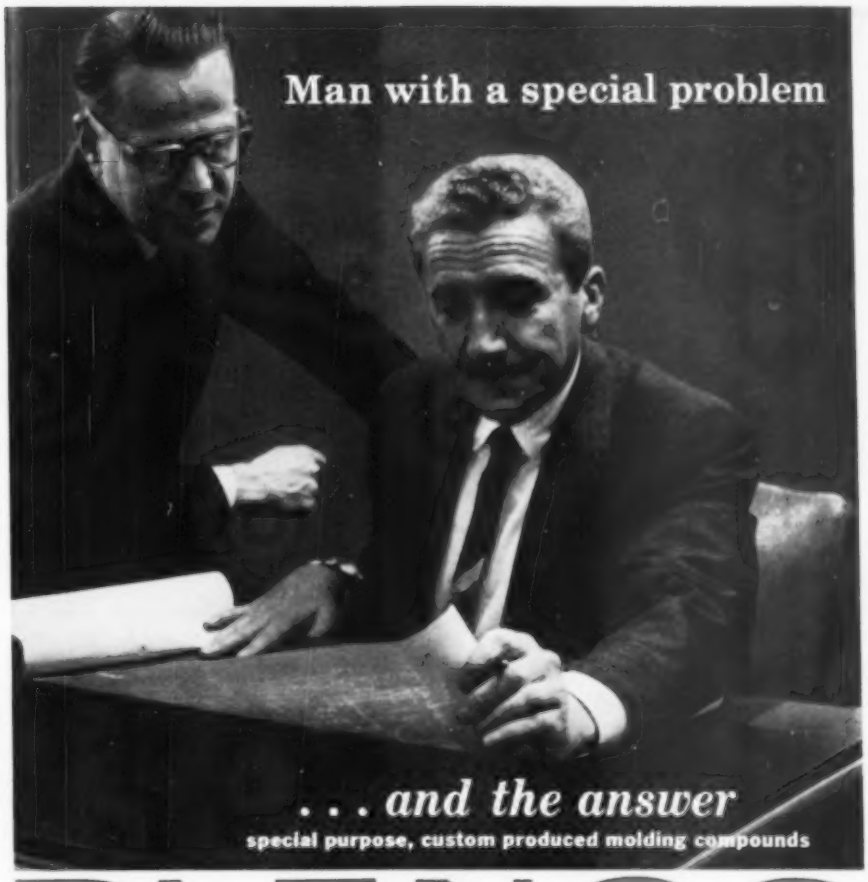
Readers' Service Item L-23

"Marlex Handbook." Phillips Chemical Co. 66 pages. This binder contains complete, up-to-date information on Marlex 50 high-density polyethylene. Individual brochures list physical properties and applications, plus information on extruded sheet, injection molding, thermoforming, Marlex types, packaging, film, thermal stabilization, and the effects of fabrication on density.

Readers' Service Item L-24

"Escambia PVC Pearls." Escambia Chemical Corp. 4 pages. Advantages, applications, and physical properties are given for Escambia Pearls 2250, 2225, 2200, and 2185.

Readers' Service Item L-25



PLENCO

Here's further evidence of the way Plenco engineers have responded to the needs of manufacturers and designers. *Special* needs, in these instances, demanding special answers.

For, although the basic properties of thermosetting phenolic molding compounds were required, the standard categories available were not ideally suited. Consultation with Plenco was a natural first step. The custom-design and production of *special-purpose* compounds by Plenco was the result. Here are just a few:

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- A special compound capable of reproducing extremely fine definition with low molding pressures for the production of printing matrixes.
- Service as a special backing for diamond abrasive cutting wheels was the chief requirement of another problem-solving new compound.
- For the production of electrical components extremely sensitive to chlorides, a compound meeting (by means of water extraction tests) a maximum chloride content of not more than 3/10 parts per million.

These compounds are, of course, not stock items. They have been developed to serve specialized industries and to perform under particular conditions. They demonstrate once again that *if phenolics can do it, Plenco can provide it* . . . already made or specially made. We invite you to discuss your product or production problem with us.

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Sheboygan, Wisconsin

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FOR BETTER PLASTIC PRODUCTS

New Literature (Cont'd.)

"Stokes Drum Dryers and Flakers." Bulletin No. 680. F. J. Stokes Corp. 4 pages. Specifications for standard-size single and double drum units are given. These drums and flakers are used for drying and solidifying materials from the liquid or molten state—at atmospheric pressure.

Readers' Service Item L-26

"Alnor Pyrotroller—An Indicating-Controlling Pyrometer." Bulletin No. 3885. Illinois Testing Laboratories, Inc. 6 pages. This instrument's simplified design is said to require less panel space (⅓ square foot). Specifications are given, along with typical wiring diagrams showing the unit's applications with electrically-heated, gas- or oil-fired equipment.

Readers' Service Item L-27

"Installation, Operation, and Maintenance of Pfaudler Glassed-Steel Reactors." Bulletin 955, The Pfaudler Co. 12 pages. In addition to the categories named in the title, information is given on gasketing for corrosive environments, jacket-cleaning techniques, repair procedures, and thermal shock, storing of equipment, and glass inspection.

Readers' Service Item L-28

"Black Diamond Sharpening Equipment." Black Diamond Saw & Machine Works, Inc. 4 pages. This illustrated folder describes and lists specifications for a rip saw and knife, a bench-type circular saw grinder, a circular saw filer, a band saw filer with setting attachment, and Wright band saw guides.

Readers' Service Item L-29

"GRC Die Cast Industrial Fasteners and Molded Nylon Fasteners." Gries Reproducer Corp. 8 pages. Specifications and schematic diagrams are given for the company's line of die-cast threaded fasteners.

Readers' Service Item L-30

"Niacet Vinyl Acetate Monomer." F-7575B. Union Carbide Chemicals Co. Operating procedures (handling), physical properties, specifications, shipping data, applications, polymerization techniques, analytical procedures, and physiological properties are given for this monomer which is said to have excellent adhesive- and film-forming properties.

Readers' Service Item L-31

"Fabrication Data on Cadco Extruded Acrylic Sheets." Bulletin EX-101. Cadillac Plastic & Chemical Co. 12 pages. Fabrication, forming, air oven heating, infra-red radiant heating, cementing, annealing, and painting are explained. Properties of a typical sheet are listed, along with other tabular data.

Readers' Service Item L-32

"Standard Industrial Chemicals—1958." Barrett division, Allied Chemical & Dye Corp. 16 pages. Properties and application data are listed for the firm's line of industrial chemicals. Twenty-seven different categories of materials are covered.

Readers' Service Item L-33

"Production of Gamma Radiation with a Linear Electron Accelerator." Report AM-100. Applied Radiation Corp. 15 pages. This report should prove useful in planning radiation research programs and laboratories, in designing commercial irradiation installations, and in investigating the technical and economic feasibility of high energy radiation processing. Data are given on radiation lengths, forward intensity, angular distribution, total conversion efficiency, spectral shape, and shielding calculations. Nine graphs are included.

Readers' Service Item L-34

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Book Reviews

"Rubber Red Book." Edited by the editors of "Rubber Age." Palmerton Publishing Co., Inc., 101 West 31st St., New York 1, N. Y. Cloth, 6 by 9¼ inches, 1458 pages (including advertisements). Price, $12.50.

A biennial directory of the rubber industry, this particular work is listed as the 1957-1958 edition. In addition to providing directory material on the domestic rubber industry, it includes information on vinyls, polyethylenes, phenolics, polyesters, and other plastics; especially those made or sold by firms in the rubber industry.

This eleventh edition contains data on 1,610 rubber manufacturers, operating a total of 1,982 factories—an increase of 200 manufacturers and 347 plants in the past two years. Over 200 pages have been added to handle the additional information.

As in previous editions, the directory provides information on rubber manufacturers in the United States and Canada; rubber machinery and equipment; laboratory and testing equipment; accessories and fittings; rubber chemicals and compounding materials; fabrics and textiles; natural rubber and related materials; miscellaneous products and services; latices; consulting technologists; sales agents and branch offices; export agents; educational courses in rubber chemistry and technology; trade and technical organizations; technical journals; who's who in the rubber industry; and a subject index.

"Employment Outlook in Plastic Products Manufacturing." U.S. Department of Labor, Bureau of Labor Statistics. Order from Superintendent of Documents, Washington 25, D.C. A reprint from the 1957 edition of "The Occupational Outlook Handbook." Paper, 6 pages. Price $.10.

This reprint summarizes the nature and growth of the plastics products industry and briefly describes the nature of available jobs, and the type training necessary to qualify for them. In its analysis, the Bureau does not concern itself with plastics departments of non-plastics industries; material suppliers; or, for instance, plastics button manufacturers which are considered part of the button industry. Pointing out that this industry has had a particularly rapid expansion in recent years, the Bureau of Labor Statistics predicts that employment in this field will increase at a faster rate that of the nation's total labor force.

"Dilute Solution Techniques for Styrene-Methyl Methacrylate Graft Copolymer and Its Precursors." R. A. Guzzi, Picatinny Arsenal, U. S. Army Ordnance Corps. Order PB 131261 from OTS, U.S. Department of Commerce, Washington 25, D.C. Paper, 20 pages. Price $.50.

This book reveals that dilute solution techniques can be adapted to the study of styrene-methyl methacrylate graft polymers and their precursors. A quantitative study and interpretation of the resulting data was not feasible because of such problems as solution color, fluorescence, opacity, microgel, uncertainty as to composition, and molecular weight distribution. However, light-scattering and viscosity measurements of samples of the graft polymers and their precursors were made and analyzed. The author recommends that when graft polymers of definitely known chemical constitution become available, their dilute solution properties be investigated.

"Textbook of Polymer Chemistry." Fred W. Billmeyer, Jr. Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. Cloth, 6 by 9¼ inches, 526 pages. Price, $10.50.

Intended as a textbook in the organic and physical chemistry of high polymers, it contains no new work and is compiled entirely from previously published information. No prior knowledge of high polymers is assumed; however, a knowledge of chemistry, elementary physics, and mathematics through calculus is required for a complete understanding of the text.

The book is divided into six sections: a general introduction to the structure and properties of polymers, their physical chemistry, the kinetics of polymerization, the properties of plastics, fiber properties, and properties of elastomers.

The section on plastics is well written, and covers processing as well as the chemistry and properties of specific materials. The appendix includes a list of symbols, physical constants, and trade names. There are many illustrations and graphs, and each chapter is concuded by a rather extensive bibliography.

"Static Electrification of Steel Cartridge Casings with Dielectric Coatings and the MK 47 Electric Primer." K. W. Bewig, Naval Research Laboratory. Order PB 131304 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 7 pages, Price, 50¢.

The government had expressed concern over the possibility of detonation of electric primers by free electrostatic charges on metal cartridge casings. Teflon coatings, used for lubricating and preserving steel casings, was known to store surface and volume electrostatic charges because of their low conductivity and small loss factor.

Tests proved that chromic oxide-loaded Teflon coatings on casings are not a hazard. They are recommended over epoxy-phenolic resin coatings because of their superior lubricating values. Clear Teflon coatings, however, will not discharge by grounding due to their low conductivity and therefore should not be used.

"Proceedings of the President's Conference on Technical and Distribution Research for the Benefit of Small Business." Order PB 131460 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 297 pages. Price, $2.50.

Based on a conference called by President Eisenhower last September 23-25 in Washington, this work covers the entire proceedings. These constitute a small businessman's guide to the research assistance he may receive from other small businesses, large businesses, Federal and State Agencies, colleges and universities, trade associations, private research and development organizations, trade publications, professional societies, technical libraries, and local business organizations.

Objectives of the conference included a study of the needs and current practices of small businessmen in technological and marketing research with the purpose in mind of determining how products and processes can be improved, how new products can be developed, how sales and profits can be increased through modern methods, and how to keep small businessmen abreast of changes in technology and marketing.

"Evaluation of Molded Polyethylene Drums in Steel, Plywood, and Wirebound Overpacks." K. D. Brunelli, Chemical Corps, U. S. Army. Order PB 121907 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 16 pages. Price, 50¢.

As a result of simulated service tests, it is recommended the molded polyethylene drums in steel drum overpacks be used to replace glass or ceramic liners in rigid shipping containers for corrosive and sensitive materials. The polyethylene drums showed a high degree of burst strength in rough handling, drop, and inclined-impact tests. Standard steel drums were found superior to plywood drums and wirebound crates which were tested as overpacks.

Abstracts of Important Articles

Materials

"New Method of Low Pressure Polymerization of Olefines," M. Hazera, *Ind. Plastiques Mod.*, 9, 6, 39 (June 1957).

Review of the method developed by the Phillips Petroleum Company for the catalytic polymerization of olefines at relatively low temperature and pressure. (In French.)

"Stabilizers for Vinyl Chloride Resins. Organic Compounds," E. Ferraris, *Materie Plastiche*, 23, 3, 225 (March 1957).

Review of organic stabilizers for vinyl chloride resins, including amino derivatives; products containing phosphorus, or sulfur; epoxide and phenolic derivatives; light stabilizers; sequestering compositions; etc. American, British, French, German, and Italian patents are mentioned. (In Italian.)

"Melamine Molding Compounds," F. Weber, *Plastica*, 10, 3, 153, (March 1957).

Swiss molding powders of melamine combined with glass fiber, textile fibers, cellulose, asbestos fibers, and wood flour, respectively, and their uses for different technical purposes are discussed. The mechanical, thermal and electrical properties are presented in tabular form. (In Dutch.)

"Friction and Abrasion Characteristics of Plastics Materials," M. A. Marcucci, *SPE J.*, 14, 2, 30 (Feb. 1958).

This 1958 Conference paper reports on work carried out to determine the frictional properties of different types of plastics materials after extended periods of contact with metal riders at relatively high loadings and rates of speed. The design and construction of the equipment used are discussed, together with test procedures and results.

"Heat Resistant Urethane Polymers," V. V. D'Ancicco, *SPE J.*, 14, 2, 34 (Feb. 1958).

A recent advance in urethane polymer technology permits improved thermal stability to be built-in. Data presented are derived principally from rigid cellular products, and indicate that a similar improvement in heat resistance of flexible cellular and non-cellular urethane products also can be achieved by the same means.

"Heat-Blast Erosion Effects on Reinforced Plastic Laminates," N. B. Miller and E. L. Strauss, *SPE J.*, 14, 2, 37 (Feb. 1958).

A 1958 Conference paper, this article describes the experimental procedure and results obtained in tests of asbestos-reinforced phenolic and glass-reinforced phenolic, polyester, and silicone laminates to determine their properties under heat-blast erosion.

"New Surface Coatings Based on Diisocyanates," M. E. Bailey, *SPE J.*, 14, 2, 41 (Feb. 1958).

A discussion of the process of conversion of liquid films into durable, solid coatings.

"Polyethylene Films," C. J. B. Thor, *SPE J.*, 14, 2, 44 (Feb. 1958).

Yield, mechanical strength, thermal properties, inertness, permeability, and optical properties of Visking polyethylene film are discussed, together with typical uses for the film.

"Vinyl Compounds for Extrusion," F. W. Wurtzell, *SPE J.*, 14, 2, 47 (Feb. 1958).

A short article on vinyl extrusion compounds dealing with addition of plasticizers, plasticizer systems, and typical formulations.

"Graft Polymerization on Polyethylene," W. G. Hammon, *SPE J.*, 14, 3, 40 (March 1958).

A 1958 Conference paper giving a basic discussion of graft polymerization. Subjects covered include types of copolymers; initiation of graft copolymerization by high-energy radiation; variables involved in graft polymerization; pre-irradiation grafting; use of soft X-rays in graft polymerization; and the grafting of various monomers on polyethylene.

"The Polyolefin Plastics Field—Present Technical Status," F. C. McGrew, *Modern Plastics*, 35, 7, 125 (March 1958).

A history of the polyolefins to the current date, with emphasis on the melt index properties, density, stiffness, abrasion resistance, and permeability of polyethylene.

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in June.

"Unsaturated Polyester Resins Containing Methyl Methacrylate Monomer," A. L. Smith and J. R. Lowry, *Modern Plastics*, 35, 7, 134 (March 1958).

Experimental procedure and test results obtained in exposure and aging tests of polyester / styrene / methyl methacrylate panels made with glass reinforcement.

"Direct Current Measurements of Technical and Pure Polymers," J. H. Kallweit, *Kunststoffe*, 47, 11, 651 (Nov. 1957).

Results of improved methods of measuring resistance of polymers to direct current under varying conditions of field intensity, temperature, time, and polarity confirmed earlier findings while, at the same time, new values were obtained which clearly show the influence of structure. A hypothesis is formulated for the mechanism of the conductivity observed which takes into account the significance of displacement phenomena. Activation energies are given for this mechanism of conductivity. (In German.)

"Accelerated Fatigue Testing of Polymethylmethacrylate," J. M. Zarek, *Brit. Plastics*, 30, 9, 399 (Sept. 1957).

Results of orthodox methods, compared with Prot's accelerated tests, suggest that the latter may be used successfully in fatigue testing of unplasticized polymethyl methacrylate, even with some simplification of the method of loading the specimen. The poor heat conductivity, together with the high mechanical hysteresis losses of the material, mean that rapid cyclic stressing gives an appreciable temperature rise of the specimen, hence a wide range for th fatigue limit. It was found that fatigue limits may vary slightly for specimens of different sizes.

"Coloring Synthetic Resins with Modified Acid Dyes During Polymerization," Z. K. Jelinek, *Plaste u. Kautschuk*, 4, 6, 209 (June 1957).

At the Research Institute for Organic Synthesis, Pardubice, Czechoslovakia, a method was developed for rendering textile dyes suitable for use with plastics by converting acid dyes with one but not more than two sulfo-groups to salts of the dye acid by means of organic quartenary bases containing a higher alkyl group. Such salts are insoluble in water, but dissolve easily in certain monomers such as styrene, methylmethacrylate, allylate and prepolymers of allylate, and pre-polymers of unsaturated polyesters, phenol formaldehyde, and epoxy pre-condensation products where they yield clear, highly colored solutions. (In German.)

"Brittleness Temperature Testing of Elastomers and Plastics." A. C. Webber, *ASTM Bull.*, No. 227, 40 (Jan. 1958).

This is a report of Subcommittee 27 (of Committee D-20 on Plastics) and giving results of brittleness temperature tests to date on vinyl, polyethylene, and three rubbers.

"The Effect of Loading Rate on Adhesive Strength," Frank Moser and S. S. Knoell, *ASTM Bull.*, No. 225, 60 (Jan. 1958).

Results of tests are given to show significant differences between loading rates, testing machines, and adhesives for metal-metal assemblies bonded with a vinyl adhesive, a modified phenolic adhesive, and a combination-vinyl adhesive.

"Polypropylene — A Promising New Plastic," C. Crespi, *Materials Design Eng.*, 47, 1, 110 (Jan. 1958).

The Montecatini author presents some information on the properties, fabricating characteristics, and potential applications of the new material.

"Effect of Temperature on Industrial Plastics Laminates," N. A. Skow, *Materials Design Eng.*, 47, 2, 109 (Feb. 1958).

Data are given on the mechanical and electrical properties of laminates at temperatures from —90 to +200° F. Tests were made on nine thermoset laminates.

"Measurement of Stresses in Cast Resins," A. J. Bush, *Modern Plastics*, 35, 6, 143 (Feb. 1958).

A testing method is described, and results of tests given, for measuring stresses in a cylindrical resin casting by use of strain gages.

"Evaluation of Casting Resins Employing Strain Gage Techniques," R. N. Sampson and J. P. Lesnick, *Modern Plastics*, 35, 6, 150 (Feb. 1958).

The strain-gage technique described by Bush in the preceding abstracted paper was used to study casting resins (epoxy and polyester types). Results are given on results obtained in tests for the effects of gelation point, polymerization stress, thermal cycling, filler content and types, and rate of cooling.

"Curing Agents for Epoxy Resins," W. H. C. Rueggeberg, J. E. Singley, C. E. Feazel, and E. A. Verchot, *Modern Plastics*, 35, 6, 154 (Feb. 1958).

Results are given of an experimental study of bis(aminophenyl)sulfones as epoxy curing agents.

"A New Low Density Molding Material," D. L. Graham, *SPE J.*, 13, 10, 35 (Oct. 1957).

This SPE 1957 Conference paper describes the method of manufacture, compositions, and products of Dow Chemical Co.'s new polystyrene bead-epoxy resin material for which patent application has been made. Suggested fields of application for the material include low-temperature insulation, buoyancy products, sandwich construction, structural low-density fillers, and low-density moldings.

"Effect of Fillers on High Humidity Insulation Resistance of Epoxy Resin Systems," H. L. Parry, J. E. Carey, and M. D. Anderson, *SPE J.*, 13, 10, 45 (Oct. 1957).

The addition of fillers to a good epoxy resin polymer impairs the performance of the system as an insulator under high humidity conditions, but there is a wide difference between fillers. The improvement in performance that sometimes results from the use of surface finishes makes this field worthy of further investigation.

"Fungus-Resistant Vulcanized Fibre," L. Stiegler, Plastics Industry, 15, 8, 18 (Aug. 1957).

A brief discussion of the material and how it can be used to solve design problems.

"Fundamental Characteristics and Technology of Polytetrafluoroethylene," E. Fachinelli, *Poliplasti*, 5, 21, 16 (May-June 1957).

The structure, properties, and principal applications of PTFE are reviewed, and the processing of the polymer in both granular form and as dispersions is described. (In Italian.)

"The Chemistry of Unsaturated Polyester Resins," P. Bonardi, *Poliplasti*, 5, 21, 23 (May-June 1957).

In this review, the author wishes to show what kind of materials the polyester resins are, how they are prepared, what basic materials are employed, and what mechanisms are involved in the hardening process. (In Italian.)

"The Problem of Uniformity in Two-Dimensional Stretching of Plastic Films," E. di Giulio, *Materie Plastiche*, 23, 5, 351 (May 1957).

The problem is first considered by the example of a stretched filament, and how a lack of uniformity may be solved by the conception of localized stretching. Lack of uniformity in the longitudinal direction of a stretched film is quite similar to that

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of a stretched filament, and also can be solved with the aid of the concept of localized stretch. The case is different for the transverse stretching of a film; here, the important point seems to be the uniformity of the original unstretched film in the transverse direction. (In Italian).

"Treating Phenolic Laminates with Transformer Oil," G. Ughetto, *Poliplasti*, 5, 21, 11 (May-June, 1957).

To determine the behavior of phenolic laminates in transformer oil, laminates with Kraft paper, as well as with cotton, nylon, and glass-fiber fabric, were subjected to the oil at 85° C. for 50 and 100 hours. For comparison, the laminates were subjected to hot air at 85° C. for 100 hours. Samples were conditioned according to ASTM standards, and subjected to ASTM impact, tensile, and dielectric tests. The results are tabulated. (In Italian.)

Equipment

"Studying High Polymers by Means of Differential Thermal Analysis," J. Coste, *Ind. Plastiques Mod.*, 9, 4, 37 (April 1957).

The apparatus used in these studies consisted essentially of two identical cells immersed in an oil bath provided with automatic heating and cooling devices. The temperature of the polymer and the difference between this temperature and that of a reference material (usually sand) were registered by means of thermocouples and the curves were obtained with the aid of galvanometer readings or direct recordings by XY-type Speedomax. By these means, the different transition states in the polymers, could be followed; such as the formation of the glassy state, the phenomena of spontaneous crystallization, changes in the crystal lattice, and behavior in the fusion zone. The method gives results approximating those obtained by calorimetry, but is much simpler. (In French.)

"The Effect of High Energy Irradiation on High Polymers," D. Heinze, *Plastverarbeiter*, 8, 3, 82 (March 1957).

After reviewing the different methods of irradiating plastics (by electron, proton, and neutron radiations, ultraviolet light, X-rays or Gamma rays) and the usual dosage units, the author discusses radiation sources and describes the Van de Graaf generator, the linear accelerator, and the electron cyclotron. The effect of treatment on polyethylene, polystyrene, natural rubber, and polymethacrylic acid esters and graft polymerization is then considered, as well as commercial prospects of the method. (In German.)

"Rheological Measurements for Identifying High Polymers," K. Edelmann and E. Horn, *Plaste u. Kautschuk*, 4, 3, 85 (March 1957).

The Umstatter Structure Viscosimeter, which operates on the capillary tube principle over a shearing stress zone exceeding 10^4 is used to obtain complete flow curves of solutions of high polymers. The author describes the apparatus and explains the calculations involved by using the example of a 2% solution of natural rubber in toluol. (In German.)

"Conical Heat Chambers," R. T. Wheeler, *SPE J.*, 14, 2, 27 (Feb. 1958).

This 1958 Conference paper discusses conical heat chambers in injection molding machines. Factors covered include five-chamber zones; melt extraction chambers; and the advantage of even stock temperatures.

"Screw Extruders for Continuous Processing of Thermoplastics," H. Hohle, *Plaste u. Kautschuk*, 4, 6, 211 (June 1957).

The development of the plastics extruders from rubber extruders first is reviewed, then details of the design and construction of the new type SN-63 extruder developed in East Germany are discussed. The emphasis in this country is mainly on high-capacity single screw machines, since these are most urgently needed by the local industry. At present, the SN series is being made with screw diameters of 32, 45, 63, and 90 millimeters. A 160 mm. type, intended chiefly for sheathing cables and for rigid PVC pipe of larger dimensions, is soon to be available. (In German.)

"Torque Measuring on an Extruder," W. J. Allen and D. A. Hillman, *Plastics (London)*, 22, 241, 423, (Oct. 1957).

Description of a mechanism for measuring the torque input on an extruder where the minimum of alteration of the extruder is specified.

"The Auxiliary Hydraulic Ram for Molding Plastics," H. Spies, *Plastverarbeiter*, 8, 4, 1935 (April 1957).

Description of equipment and method used to mold plastic handles of table-ware and manicure instruments by the double-plunger method. (In German.)

Processing

"A New Breaker Plate for Coloring Polyethylene," J. E. Simpson, *SPE J.*, 14, 3, 27 (March 1958).

The dry-coloring process for in-plant coloring of polyethylene for injection molding involves a major problem in dispersion of colorant. Results of tests show the importance of orifice diameter in the breaker plate, especially for the high-melt index polyethylenes. These resins require a decrease in the orifice diameter.

"Methods for Joining Plastics Parts," A. J. Cheney and W. E. Ebeling, *SPE J.*, 14, 3, 31 (March 1958).

Four methods of joining plastics are discussed in detail. They include blind riveting, press fitting, induction welding, and spin welding. The methods are described in detail so that they can be adopted quickly and successfully to new productions.

"PVC Dry Blend Extrusion," E. H. Hankey and R. D. Sackett, *SPE J.*, 14, 3, 43 (March 1958).

It is shown that properly designed extrusion equipment is of major importance for the success of the process. Experimental data are given to cover differences in behavior of dry blends and compounds in the extrusion operation.

"Electronic Heat Sealing," R. D. Farkas, *Modern Plastics*, 35, 7, 109 (March 1958).

Factors important to design and use of dielectric heat sealing are discussed in terms of the theory underlying the method.

"Molding Shrinkage and Related Effects in a Fixed-Cavity Compression Mold—Part 2," W. R. McGlone and L. B. Keller, *Modern Plastics*, 35, 7, 117 (March 1958).

Presented in this concluding section of the article are data showing that the density of non-porous parts is uninfluenced by changes in molding conditions, except in special cases. The thermal coefficients of the compounds investigated were greater in the force direction than in the flow direction. These coefficients change with repeated reheating, and reduce to minimum values.

"Processing and Care of Plastic Sheet for Decorative Purposes," H. Cuno, *Kunststoffe*, 47, 10, 625 (Oct. 1957).

Exact details are given on methods and tools to be used in preparing and applying decorative plastic facings to walls and furniture. Special attention is given to cutting and bonding processes, the bending of sheet, and the choice of beading. Several ways of covering walls with plastic are described. (In German.)

"Sintering Thermoplastic Materials," T. Engel, *Plastverarbeiter*, 8, 4, 131 (April 1957).

The history of sintering, the process itself, and its applications are discussed. Methods are described of producing both supported and unsupported components of polyethylene and polyamide by the whirl-sintering process. (In German).

"Manufacture of Cubical Containers from Polyester Resin," K. H. Bode, *Plastverarbeiter*, 8, 4, 139 (April 1957).

Brief description of the steps in the manufacture of rectangular and cubical containers of glass-reinforced polyester resins intended for the chemical and other industries. (In German.)

Applications

"The Future of Plastics in the Automotive Industry," C. A. Chayne, *SPE J.*, 14, 3, 25 (March 1958).

An optimistic view of the outlook for plastics in the automotive field.

"Epoxy Resins for Electrical Applications," W. E. Weber, *SPE J.*, 14, 3, 49 (March 1958).

Test methods used in selecting epoxy casting resins for electrical applications are described. Essential requirements for a resin system include high electrical resistivity, thermal shock resistance, low dissipation factor, and low volatile loss.

"The Use of Plastic Pipe for Conveying Drinking Water," A. Muller and W.

Schwartz. *Kunststoffe*, 47, 10, 583 (Oct. 1957).

The usual chemical, physical, medical, and bacteriological tests are held to be inadequate for determining whether or not plastic pipes are suitable for conveying drinking water. The authors describe a new method for determining bacteriological corrosion in plastic pipe, and the results of its application in a water-works. Since manufacturing processes, compounding, nature of the ingredients, and the like also play a part in microbial attack, in addition to the nature of the polymer used, it is recommended that manufacturers of plastic pipe themselves exercise strict control over methods, and guarantee that manufacturing conditions and procedures are always the same so that a mark of quality, "Suitable for Drinking Water," could be introduced. (In German.)

"Insulating Buildings with Oppanol BA Foil," W. Daniel, *Kunststoffe*, 47, 10, 606 (Oct. 1957).

Oppanol BA is a polyisobutylene product that has proved suitable for insulating buildings. Applications and the fundamentals of laying the foils are treated briefly. (In German.)

"Plastics in Surface Finishes," H. Disselhoff, *Kunststoffe*, 47, 10, 607 (Oct. 1957).

Alkyd resin varnishes (two-component varnishes based on urea or melamine and formaldehyde or isocyanates, also polyester and epoxide resin products) are considered in addition to synthetic resin dispersions used in the production of binders, wall paints, jointless floorings, superior surface finishes, and also for improving adhesion and shock resistance of cement mortars. (In German.)

"Plastic Profiles in the Building Industry," A. R. Bohm, *Kunststoffe*, 47, 10, 630 (Oct. 1957).

The damping properties of plastics make them serviceable for many purposes in the building industry. Among others, as fillers for expansion joints, moldings for baseboards, sound-insulating pipe connections, dowels, and seals for doors and windows. (In German.)

"Plastic-Covered Iron Wire," K. H. Hahne, *Kunststoffe*, 47, 10, 634 (Oct. 1957).

Steel and iron wire netting provided with anti-corrosion PVC coverings in a variety of colors are finding increased application in buildings and as fencing. Polyamide and polyethylene also are suitable for these purposes, but still are expensive for general use. Methods of covering the wire with PVC are described. (In German.)

"Floor Coverings," E. Fortun, *Kunststoffe*, 47, 10, 569 (Oct. 1957).

After a general consideration of the requirements that any type of floor covering must meet, the author discusses in detail the properties, method of laying, and care of PVC floor-coverings, jointless flooring compositions, asphalt tiles, and linoleum. Finally, testing methods and quality are dealt with in connection with standardization work. (In German.)

"Open-Cell Foams for Acoustic Applications in Buildings," H. W. Paffrath, *Kunststoffe*, 47, 11, 638 (Nov. 1957).

The author introduces his subject with a description of a simple experiment to explain the mechanism of sound absorption by elastic, open-cell plastic foams. It is shown how sound absorption can be improved by partially insulating the foamed material with a perforated layer of paper or with a porous paint. Various applications in buildings then are discussed. (In German.)

"Plastic Foams as Anti-vibration Material for Vehicle Bodies," E. A. Hampe, *Kunststoffe*, 47, 11, 640 (Nov. 1957).

After an explanation of the origin of the annoying rumbling and grinding noises made by motor vehicle bodies, the possibilities of overcoming them are examined; among others, covering the sheet metal surfaces with damping materials. Such materials would have to meet numerous requirements. How useful foamed plastics would be for reducing noises and vibrations in motor vehicles and trains is considered, and their limitations noted. Tests are described in which floors of vehicles were provided with a composite cover (consisting of a stiff rubber matting over a layer of Moltoprene) with promising results. (In German.)

"Plastics in Boats," H. A. Collinson, *Trans. Plastics Inst.*, 25, 61, 154 (July 1957).

Review of the use of plastics in small

In Brief . . .

El Paso Natural Gas Co., Odessa, Tex., and Seamco Chemical Co., Holyoke, Mass., have signed a basic contract whereby styrene produced by the former will be converted to polystyrene by the latter. In addition, the two firms will participate in joint plastics research, facilities for which will be constructed in Holyoke.

Rubber & Asbestos Corp., Bloomfield, N. J., manufacturers of industrial adhesives, have announced the availability of their rubber and resin milling and dissolving facilities on a custom order basis. Equipment currently owned by the company includes a battery of 3,000-gallon churns which permit the manufacture of one uniform batch of material in up to truckload quantities.

Farrel-Birmingham Co., Ansonia, Conn., has moved its Akron, O., office to 665 W. Market St. This relocation provides more modern and spacious quarters, and permits the firm to facilitate better service in the Akron territory on its products and those of its Consolidated Machine Tool and Watson-Stillman Press Divisions.

Celanese Corp. of America, New York, N. Y., has begun construction of a new manufacturing unit at its Belvedere, N. J., plant to increase its production of polyvinyl acetate emulsions that previously were made at its Linden, N. J., plant. This will be a new activity for the Belvedere plant which makes cellulose acetate and cellulose propionate molding powders, and cellulose acetate extruded and cast film.

Becco Chemical Division, Food Machinery & Chemical Corp., Buffalo, N. Y., has announced new and lower prices for development quantities of five epoxy compounds. The new per-pound prices for the compounds in 55-gallon drums are as follows: octylene oxide, $1.10; dodecene oxide, $1.55; C_{16}-C_{18} olefin oxide, $1.55; dipentene monoxide, $1.20; and alpha-pinene oxide, $1.20.

Disogren Industries, Inc., formerly located at New York International Airport, has moved into larger quarters at Mount Vernon, N. Y. The firm manufactures gaskets, seals, O-rings, shock mounts, and other products from Disogren polyurethane elastomer.

Taylor Fibre Co., Norristown, Pa., has moved its New England branch office from West Newton, a suburb of Boston, to 967 Farmington Ave., West Hartford, Conn.

Tri-Point Plastics, Inc., Albertson, N. Y., designers and fabricators of precision plastics components, has appointed S. W. Goodman Co. as their technical sales representative in Maryland, the District of Columbia, and Northern Virginia.

Bakelite Co., division of Union Carbide Corp., New York, N. Y., withdrew from the manufacture and sale of polyester resins, effective January 1, 1958. The firm continues its interest and activities in epoxy and phenolic resins for use in reinforced plastics, and substantial market growth is anticipated for these plastics.

Foster Grant Co., Inc., Leominster, Mass., is sponsoring a fellowship to the Polytechnic Institute of Brooklyn for a graduate student from the Leominster area who is a child or a close relative of one of its employees. The fellowship covers a $2,000 stipend, tuition, and costs of materials and supplies.

Bolta Products Division, The General Tire & Rubber Co., Lawrence, Mass., has announced a new line of Boltaflex upholstery materials. Designated Flamenco, the line is characterized by brilliant colors, and consists of 18 different shades in popular, metallic, and vivid hues, available in both all-vinyl and fabric-supported grades.

Delkay Plastics Corp., Gardena, Calif., has occupied a new building at 13441 S. Western Ave. This move gives the firm approximately four times the plant area they formerly had in Inglewood, Calif., and permits further expansions of their facilities in the future. The firm's primary work is custom injection molding of all available thermoplastics, with emphasis on industrial and pharmaceutical applications.

Cadillac Plastic & Chemical Co., Detroit, Mich., has been appointed national distributor for Bakelite epoxy resins and hardeners, made by Bakelite Co., New

(*Continued on p. 390*)

craft and yachts, ocean liners, and cargo vessels; as glues; for navigation instruments, sails, and laminates, etc.; and especially in the production of glass-reinforced plastic boats. The author agrees with the opinion of others that the optimum range for reinforced plastic boats is between 30-120 foot lengths. Mention is made of promising tests with a solution of DDT in a base of butylated urea resin and an alkyd resin as an insecticidal coating for ships sailing in tropical waters.

"The Use of Expanded Polystyrene in the Building Industry," B. Ikert, *Kunststoffe*, 47, 10, 579 (Oct. 1957).

The general properties of expanded polystyrene (Styropor) and its applications in the building industry are reported on briefly. (In German).

"Plain and Corrugated Glass Fiber-Reinforced Polyester Sheet, A Modern Building Material for Good Light and Sun Transmission," C. V. Brunswick, *Kunststoffe*, 47, 10, 580 (Oct. 1957).

The mechanical and light-transmitting properties of plain and corrugated reinforced polyester sheet are briefly considered. The forms and sizes in which the sheet is available are mentioned, and various applications are pictured. (In German.)

"Plastic Foils in the Building Industry," H. E. Kruger, *Kunststoffe*, 47, 10, 589 (Oct. 1957).

The psychological and technical reasons for the growing use of plastic foils and sheet in buildings and construction are discussed. Various applications in interior decoration, for greenhouses, collapsible and portable halls, protective coverings for concrete structures, window fittings, etc. are described. (In German).

"Synthetic Resins and Bonded Wood Compositions in Buildings," L. Skark, *Kunststoffe*, 47, 10, 592 (Oct. 1957).

Synthetic resins are finding increasing application in the assembly of parts of wood structures, as well as in the production of plywood, wood-fiber board, and wood-chip board. The different ways in which these materials are used are briefly dealt with, and several applications are illustrated. (In German.)

"Plastic-insulated and Sheathed Electric Circuits for Buildings," H. J. Hilgendorf, *Kunststoffe*, 47, 10, 595 (Oct. 1957).

Various types of plastic insulated or sheathed conductors and cables, and the methods of laying them are described, including those for use in open air, in dry and damp surroundings; earth cables, flexible circuits, low tension, and telephone and telegraph circuits. The properties of the cables and their applications are defined. (In German).

"Silicones for Protecting Buildings," E. Pirson, *Kunststoffe*, 47, 10, 597 (Oct. 1957).

The structure of silicones, their water-repellent action and other properties that make them suitable for protecting buildings, are considered. The mechanism of the protective effect and the forms in which the silicone preparations are available are described. Applications are discussed. (In German.)

"Applications of Plastic Foams Produced in Situ," H. Baumann, *Kunststoffe*, 47, 10, 601 (Oct. 1957).

The author gives examples to show how plastic foam insulations that are produced in situ can be used efficiently and economically to insulate new buildings and to improve or repair existing insulations in older buildings. Plastic foams, it is pointed out, have the added advantage of resisting attacks by termites and fungi, without the need for the addition of toxic compounds. (In German.)

"New Facts about the Properties and Physical Behaviour of Polystyrene Foams," H. Osken, *Plastverarbeiter*, 8, 4, 123 (April 1957).

After discussing the mechanical and thermal properties of rigid and flexible Poresta (trade name for polystyrene foam), the author deals with the material's acoustic behavior. He describes the method of using a layer of Poresta under a floating plaster ceiling to reduce sound and resonance in buildings, and in combination with a layer of Moltoprene to serve the same purposes in humid places such as indoor swimming pools. (In German.)

"Plastics In Agriculture," R. Pozzo, *Materie Plastiche*, 23, 5, 331 (May 1957).

Review of the use of plastics for conveying water and other liquids in connection with agriculture for use in cultivation and for various applications related to agriculture. Reference is made to practice in the United States, as well as in Italy and other European countries. In Italian.)

"Plastics in the Footwear World," N. Sacchi, *Materie Plastiche*, 23, 5, 335 (May 1957).

General article on the use of PVC, particularly, but also of nylon, polystyrene, polyethylene, and methacrylate in the footwear industry. Special reference is made to developments in Italy. The properties of two basic mixes of Vipla (PVC) for footwear are listed, and the treatment of special purpose leather with superpolyamides is mentioned. (In Italian.)

"Lined Plastic Tubes for Packing Cosmetics," G. Mylius, *Plaste u. Kautschuk*, 4, 5, 178 (May 1957).

Tubes of plasticized PVC filled with tooth paste or highly perfumed stearate face creams remained unchanged during a storage period of 12 months when the tubes were made with an insulating lining of rigid PVC or Hostaphan film. East German firms are warned to utilize this new idea soon for as soon as manufacturers abroad learn of it, they will not hesitate to exploit it. (In German.)

"Silicone Rubber as Processing Aid for Glass Fiber Reinforced Polyester Resins," F. Schafer, *Kunststoffe*, 47, 6, 314 (June 1957).

The material of which a mold is made and its construction, as well as the release agent employed, often are responsible for difficulties encountered in processing unsaturated polyester resins. The author shows how some of these difficulties may be overcome by using silicone rubber as the release agent, as a structural material in new and old methods of mold construction, and as packing material in vacuum and bag-molding. (In German.)

General

"Toxicology of Plastics Materials," R. Segura Ferns, *Revista Plasticos*, 8, 46, 207 (July-Aug. 1957).

After a brief general consideration of toxicity and toxic effects, the author discusses the toxicology of plastics in plants, plastics products, and plastics used in the food industry, for hygiene, and in medicine, surgery and cosmetics. (Spanish.)

"Thirty Years of Plastics," M. Parducci, *Materie Plastiche*, 23, 5, 367 (May 1957).

Review of the development of the plastics industry in Italy from 1926 to 1955, inclusive. Tables are given for the consumption of energy, goods transported, development of industrial products, population, income, average daily expenditure by Italians, and motor vehicles used in 1926. These are compared with similar data for 1955. (In Italian.)

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Patent Digest

Materials

Phenol-Formaldehyde Molding Composition for Plastic Closures. No. 2,803,608. Carlton A. Richie, Toledo, O. (to Owens-Illinois Glass Co., Toledo, O.).
The composition consists of 100 parts by weight of phenol-formaldehyde resin, 24-36 parts of woodflour, 12-30 parts of kaolin, and small amounts of carbon black and zinc stearate.

Ethoxylin Resin Compositions and Process of Hardening Such Resins. No. 2,803,609. Felix Schlenker, Wiesbaden, Germany. (to Chemische Werke Albert, Wiesbaden-Biebrich, Germany).
A polyvalent metal-carboxylic acid salt drier is incorporated in an unmodified epoxy resin having free epoxy groups, to produce an resin composition having improved heat-hardening qualities.

Fibrous Glass Reinforced Resinous Molding Compound. No. 2,804,438. Lawrence P. Biefeld, and Richard F. Shannon, Lancaster, O. (to Owens-Corning Fiberglas Corp., Toledo, O.).
A molding composition consisting of an uncured, thermosetting, liquid, low pressure eliminating resin; glass fibers in an amount ranging from 1-25% of the volume of the product to be molded; and calcium carbonate in a finely-divided form combined with the resinous material as a diluent in amounts in excess of 50% by weight, but less than 75% by weight of the total mass.

Polymerization of Lactam With Mixed Catalysts. No. 2,805,214. Joseph Zimmerman, Wilmington, Del. (to E. I. du Pont de Nemours and Co., Wilmington, Del.).
An improvement in the catalytic polymerization of lactams of amino-carboxylic acids having at least 5 aliphatic carbon atoms between the amine and carboxyl groups, which consists of employing catalytic amounts of an alkali-metal hydroxide, and a material in a class consisting of the alkali metals, and their amides and hydrides. Each of the components are added in an amount more than 0.1 mol percent based on the lactam. The viscosity of the reaction mixture increases continuously with time to an equilibrium value without passing through an initial peak value.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

Process for Preparing Expanded Organic Polymeric Materials and a Blowing Agent Therefor. No. 2,804,435. Ronald A. Reed, Quorn, England. (to Whiffen and Sons, Ltd., London, England).
A gas-producing composition comprising a mixture of azodicarbonamide, and from 1-5% by weight of biurea is incorporated into a polymeric material consisting of polyethylene and a partially gelled homopolymeric vinyl chloride. The resultant material is heated to a temperature in the range 150-230° C.

Production of Polymers From a Cyclic Carbonate of an Alkylene Glycol With a Mono-Ester of a Dicarboxylic Acid and a Mono Hydroxy Compound. No. 2,802,807. James Gordon Napier Drewitt, Spondon, and James Lincoln, London, England. (to British Celanese Ltd., London, England).
A high linear polyester is produced by mixing a cyclic carbonate of an alkylene glycol, a mono-ester of a dicarboxylic acid, and a mono-hydroxy compound, with a molten low linear poly-ester of intrinsic

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viscosity 0.1-0.4 at a temperature above 200° C. The mono-hydroxy compound is volatile at the given temperature. Heat is applied until further molten low polyester has been formed, and the resultant product may become fibre forming.

Equipment

Process of Manufacturing Synthetic Pearl Essence. No. 2,807,858. Gideon E. Livingston, Amherst, Mass. (to Argenta Products Co., Eastport, Me.).

A solution of normal lead acetate having a concentration no greater than 50% is heated to 50-100° C., while its pH value is controlled between 4.5-7.0. Carbon dioxide gas is passed through the solution forming relatively large and lustrous crystals of lead carbonate having optical properties approximating those of natural pearl essence. The crystals are removed from the solution as soon as possible after they are formed to prevent lumping due to over-carbonation.

Coated Polymeric Themoplastic Dielectric Film and Method for Producing Same. No. 2,808,347. Philip Strubing Blatz, Buffalo, N.Y. (to E. I. du Pont de Nemours and Co., Wilmington, Del.).

A balanced, biaxially-oriented, heat-set polyethlene terephthalate base is coated with a composition consisting of 20 parts by weight of chlorosulfonated polyethylene; eight parts of litharge; 0.5 part of hydrogenated wood rosin; 0.2 parts of mercaptobenzothiazole; 10 parts of an estersil comprised of a supercolloidal substrate having a surface of silica coated with —OR groups; and 200 parts of carbon tetrachloride. The coated film is heated to a temperature of 150° C. for 15-30 minutes to cure the chlorosulfonated polyethylene.

Apparatus for Laminating Glass Sheets. No. 2,810,668. James H. Bolcey and Robert F. Leck, Toledo, O. (to Libbey-Owens-Ford Glass Co., Toledo, O.).

A flexible, air-tight, envelope encloses a frame that is fitted with a plurality of recesses for receiving the glass-plastic sandwiches to be laminated. Means are provided for evacuating air from the recesses through a vacuum connection in the bag.

Process for Foaming Resins Using Furan Adduct Foaming Agents and Foamable Compositions Containing Same. No. 2,808,379. Henry A. Walter, Longmeadow, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

A Diels-Alder adduct of furan and a compound taken from the group consisting of maleic acid, maleic anhydride, fumaric acid, and their respective acid chlorides and esters, are mixed with a fusible synthetic resin at temperatures below 135° C., after which the mixture is subjected to a temperature between 130-200° C.

Machines for Molding Plastic Articles. No. 2,808,620. William Schmid and John E. Poole, Toledo, O. (to Owens-Illinois Glass Co., Toledo 1, O.).

The device consists of a number of molding units movable about a vertical axis, and means for moving them continuously. The units comprise a force plug having its axis disposed vertically; a cavity mold axially aligned with the force plug and formed so as to be non-rotatable relative to an article being molded; a mold holder connected to a means for moving the mold vertically to and from a position to enclose the force plug; a spring for yieldingly holding the mold against rotation; a pin and stop to determine the limits of rotary motion; and a radial finger on each cavity mold and a stationary bar positioned to engage the finger and rotate the mold through a predetermined angle and then release it for reverse rotation under influence of the spring.

Apparatus for Laminating Thermoplastic Film Sheets. No. 2,810,423. Murray O. Longstreth and Gilbert J. Ward, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

An apparatus for laminating two sheets of compatible organic thermoplastic compositions, one of which is oriented, consists of a stack of at least three driven calender rolls; an adjacent pair of rolls having circumferential grooves near each end; two pairs of sheaves mounted above the stack; and an endless cable extending about one of the sheaves of each pair, then over and half-around the outer roll of the grooved pair. It passes through the nip between the grooved rolls, half around the other grooved roll, around the second sheave, and returns to the first sheave. A means is provided for supplying hot, unoriented plastic sheet to the nip between the grooved rolls, while a second means supplies oriented plastic film of a width greater than the distance between grooves over the outer grooved roll and under the endless cables.

Method and Apparatus for Making Reinforced Plastic Tubing. No. 2,810,424. Ernest E. Swartswelter, Pittsburgh, Pa., and Gilbert V. Kullgren, Akron, O. (to Aetna Standard Engineering Co., Pittsburgh, Pa.).

The apparatus comprises an extruder embodying means for heating thermoplastic material; means for continuously extruding an inner, tubular thermoplastic member in a heated state; a braider immediately following the extruder for applying a circumferential wrapping to the exterior of the inner tubular member while it is still soft; and another extruder, immediately following the braider, for applying an outer tubular member over the wrapped inner member.

Extrusion Press. No. 2,810,159. Herrmann Teichmann, Wolfratshausen, Germany. (to Krauss-Maffei A.G., Munich-Allach, Germany).

The extrusion press comprises a tubular housing having an open outlet end, and containing a worm screw mounted on a rotatable shaft; plus a milling head coaxially fixed to the shaft for rotation therewith, and located beyond the outlet end of the housing. The milling head is formed in its outer surface with axially extending grooves of semi-circular cross-section, and is surrounded by a similarly designed tubular milling casing, fixed coaxially to the outlet end of the tubular housing containing the worm screw. The milling head receives a coaxially-fixed end portion which extends into a nozzle. The outer surface of the end portion is similar to, and spaced from, the inner surface of the nozzle. It extends in the direction of material flow so that there are no dead spaces to retain material.

Molds for Plastic Blowing Machines. No. 2,810,160. Ray Bottleman, Fitchburg, Mass. (to Great American Plastics Co., Fitchburg, Mass.).

A mold, adapted to blow closed, hot plastic tube blanks, consists of two halves each having a cavity complementary with the second half in the shape of the article to be produced. Each mold half has a pinching wall defining an area of the article. One mold half is fitted with a pin-receiving recess designed to receive a plastic blank-holding pin that projects from the other half, so that a tube blank can be held while the mold halves are open.

Compensating System for Presses. No. 2,809,542. Heinrich B. Albers, Malverne, N.Y. (to Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.)

In a hydraulic press having a fixed and movable platen, wherein tilting movement

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of the movable platen is compensated by an oppositely-directed motion, the improvement comprises a hydraulic cylinder and piston units mounted on one of the platens and an actuating contact means on the other. The hydraulic units and contact means are so spaced that they come into operating engagement at a predetermined position only within the working range of the stroke.

Compensating System for Presses. No. 2,809,543. Alexander Zeitlin, White Plains, N.Y. (to Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.).

In a hydraulic press incorporating an improved compensating system similar to that described in No. 2,809,542 (above), the addition of a series of intermediate fluid operated cylinders; a series of pistons coacting with them; a fixed frame for carrying one of the series; a single cross-head, movable on the frame, for carrying the other series; a plurality of fluid connections, each of which joins one of the compensating cylinders to one of the intermediate cylinders; and an actuating means, connected to the cross-head, to generate pressures in the cylinders for opposing the tilt of the movable piston.

Screw Press for Working Plastics. No. 2,802,238. Roberto Columbo, Turin, Italy (to S.A.S. Lavorazione Materie Plastiche di M.I. Columbo & C., Turin, Italy).

The screw press has a central, multiple-thread screw which engages a plurality of lateral screws having a smaller number of threads. A casing encloses the screw.

Apparatus and Method of Expanding Plastic Product. No. 2,802,430. Isidore J. Filler, Atlanta, Ga.

An apparatus for forming an expanded product: a casing which provides a pressure chamber having an inlet and an open outer end to which is secured an extrusion plate; a shaft mounted longitudinally for rotation within the chamber; and a material-advancing screw supported by the shaft. The holes in the extrusion plate are small at the inner surface and have progressively increasing diameters as they approach the outer surface.

Plastic Blow Molding Apparatus. No. 2,804,648. Robert G. Strauss, Hartford, Conn. (to Plax Corp., West Hartford, Conn.).

The apparatus consists of an extruder, a heated measuring chamber, an extrusion nozzle, and a mold to receive and form the discharged material. The chamber is provided with a floating piston and a valve for selectively connecting the extruder with the chamber on opposite sides of the piston, and for concurrently connecting the chamber with the nozzle. The oscillating device is provided with an adjustable stop means for limiting the movement of the valve between selected positions.

Plastic Moulding Machines. No. 2,804,649. Brian J. D. Hupfield, Edgeware, England.

A plastic molding machine consisting of a fixed mold, and a heating cylinder slidably-mounted to reciprocate with respect to a fixed ram. The cylinder, which is reciprocated by means of a single, hydraulically-operated piston, has front and rear chambers in valved communication with each other. The front chamber accommodates a slidable nozzle, while the rear chamber has an inlet that is opened and closed by movement of the cylinder relative to the ram. Forward motion of the cylinder forces molten molding material through the nozzle into a fixed mold, and simultaneously permits passage of raw material into the inlet. Return movement forces pre-heated raw material from the rear to the front chamber.

Extrusion Head of an Apparatus for the Manufacture of Tubes or Hoses from Plastic Material. No. 2,805,446. Otto Floris Bartoo, Rijswijk, Netherlands. (to Nederlandse Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek ten behoeve van Nijverheid, Handel en Verkeer, The Hague, Netherlands).

The extrusion head is provided with a mandrel surrounded by a tubular die in such a manner as to provide an annular orifice at the discharge end. The opposite end of the tubular die is firmly secured to the body of the extrusion head. Part of the die member is thin-walled to allow a radical displacement of its discharge end relative to the mandrel, thus permitting an increase or decrease in the opening between the mandrel and the die. A mechanical means is provided to cause this displacement and to maintain the die in the desired position.

Extruder Assembly for Extrusion of Tetrafluoroethylene Polymer Tubes. No. 2,817,113. Reuben Thomas Fields, Wilmington, Del. (E. I. du Pont de Nemours and Co., Wilmington, Del.).

An extruder assembly comprising a source of polytetrafluoroethylene, and a die and core which defines an annular space. The die has a feed zone adjacent to the source and is designed with a gradually-diminishing diameter in the direction of polymer flow. The feed zone communicates with a constant-diameter forming zone which is defined by the annular space between die and core. A radial-finned spider in the feed zone holds the core in place. The fins have peripheral edges tapered to fit the die, plus a single serrated edge facing the orifice.

Nozzle for Injection Molding. No. 2,817,115. Milton Freifeld, Springfield, and Roland D. Keeney, Ludlow, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

The nozzle comprises a casing having a frustro-conical inner surface, whose large and small diameters form, respectively, the inlet and exit ports. A threaded insert, immovably mounted at the inlet, receives a shaft which conforms with, and extends toward the exit port. A means is provided for turning the shaft to regulate its longitudinal position. The insert, shaft, and inner surface of the casing form an adjustable material chamber.

Injection Moulding Machines. No. 2,798,256. Elysee Eynard, Lyon, France.

The apparatus is made up of a cylinder having a discharge nozzle at its closed end, and a lateral feeding aperture near its open end. A freely-slidable tubular piston has a lateral feeding aperture which registers with that of the cylinder. The piston, whose stroke can be limited, incorporates a movable plunger.

Processing

Joining Separate Molded Sections of Polyethylene. No. 2,803,865. George Eljanian and Paul J. Andonian, Worcester, Mass.

A hollow, closed polyethylene article is molded in two or more sections having mating edges arranged for permanent connection. The connection comprises a series of integral extending pins at the edges of one section, and integral rearwardly-directed hollow members at the mating edges of another. The hollow members have a restricted passage to accommodate an enlarged portion of each pin. The polyethylene material is resilient and sufficiently distortable to allow the enlarged portion of the pins to snap past a constricted portion of the hollow members. The enlargements and the restricted portions are so located as to hold the mating edges in the same plane, and in permanent contact throughout the complete extent of the edges.

Method of Toughening Golf Ball Covers. No. 2,805,072. Wendell V. Smith, Nutley, N. J. (to U. S. Rubber Co., New York, N. Y.)

A golf ball having a winding of rubber threads under tensions and covered with a material selected from the group consisting of balata and polyethylene is bombarded with electrons having a voltage from 200-800 kv. The cover acquires good scuffing and cutting resistance without damaging the winding, when the irradiation dosage is maintained between 5×10^{-5} to 2×10^{-3} coulombs per square inch.

Method for the Preparation of Formed Thermoplastic Sheets Having a Resin Foam Integrally Bonded Thereto. No. 2,806,812. Edmund H. Merz, Wilbraham, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

A manufactured article consisting of a formed thermoplastic sheet to which is bonded a layer of foamed resin is made by charging a foamable resin composition into a mold cavity which has a plurality of rods projecting from one surface to the other; foaming the resin so as to fill the cavity; removing the mold half with the rods while leaving the foamed composition (which now contains a plurality of through-holes) at rest in the remaining mold section; covering the resin with a thermoplastic sheet; and applying a vacuum to the mold to draw the sheet into engagement with the resin foam.

Process for Preserving Regenerated Cellulose Pellicle. No. 2,804,736. Ellis Irving Lichtblau, Buffalo, N. Y. (to E. I. du Pont de Nemours and Co., Wilmington, Del.).

Pellicular structures of gel regenerated cellulose are preserved by impregnating them with an aqueous solution of an alkali metal salt of dichlorophene, precipitating

dichlorophene in the structure by passing it through a dilute acid solution, and thereafter placing it in an aqueous solution comprising ortho tolyl biguanide.

Formation of Elongated Thermoplastic Shapes in Vibratory Forming Tube. No. 2,802,237. William J. Davis, Reading, Pa. (to Polymer Corp., Reading, Pa.).

High melting polyamide materials are continuously pressure-fed into one end of a forming tube. During their transit, the materials are cooled to provide for a continuous delivery of a substantially solidified, elongated shape. A relative vibration is effected between the tube and the polyamide to prevent adhesion.

Method of Making Cellular Plastic Articles. No. 2,802,240. Frank W. Thomas, Burbank, Calif. (to Lockheed Aircraft Corp., Burbank, Calif.).

A cellular, liquid reactant mixture of phenol formaldehyde resin containing a divided metal gassing agent, approximately 11% polyvinyl alcohol, and an aromatic sulfonic-phosphoric acid aqueous solution catalyst is applied uniformly to the surface of a die so that the thickness of the liquid layer is substantially less than the desired thickness of the finished article. The material is air-cured at room temperature for 15-30 minutes, then oven-cured at a temperature of about 150° for 1-2 hours. The layer sets to form a plastic article having a hard, glossy surface substantially parallel to the surface of the die.

Method for Molding Fiber Reinforced Plastic Articles. No. 2,803,043. Joseph P. Stephens, Kansas City, Mo. (to Gustin-Bacon Mfg. Co., Kansas City, Mo.).

Fibers, suspended in a fluid resin, are flowed into a mold cavity. Resin is bled from the mold at predetermined points to effect a concentration of fibers in selected portions of the mold cavity and the molded object.

Method of Molding Plastic Articles. No. 2,811,408. Orville A. Braley, Midland, Mich. (to Dow Corning Corp., Midland, Mich.).

Organic and organosilicon plastic articles are formed in a wood, plastic, ceramic, or metal mold whose surfaces are coated with copolymer consisting essentially of trimethylsiloxane and silicon dioxide units in such proportion that the ratio of methyl radicals to silicon atoms is from 1:1-2.5:1 inclusive. The plastic article can be formed from any material other than the release agent.

Polytrifluorochloroethylene-Coated Aluminum. No. 2,811,471. Henry N. Homeyer, Jr., Milford, Conn. (to Connecticut Hard Rubber Co., New Haven, Conn.).

A mixture of high molecular weight, solid polytrifluorochloroethylene and a waxy plasticizer of the same material is applied to an aluminum surface that has been treated with an aqueous solution of sulfuric and chromic acids. The coated object is heated and quenched to form a securely adhered film on the aluminum.

Method of Making Plastic Bottles. No. 2,810,934. James Bailey, West Hartford, Conn. (to Plax Corp., West Hartford, Conn.).

A thermoplastic material is extruded about a mandrel contained in a multi-section mold. The charge is severed from the parent body of material at a point remote from the mandrel, after which the mold is closed to form the charge between the mandrel and the mold-sections. Air-pressure is introduced into the charge to blow a portion of it into contact with the mold.

Method of Printing Polyethylene For Bulk Packaging. No. 2,811,106. Joseph Albert Picarello, River Edge, N.J. (to American Cyanamid Co., New York, N. Y.).

A letter-press and resilient type are used to form plastic printing ink impressions on a moisture resistant polyethylene sheet. The printed surface is heated to about 74° C. for not less than 10 seconds, after which it is chilled to about —30° C. for not less than 15 seconds. The sheet then is heated slowly to room temperature to form a printed area that is resistant to pull-off and smearing.

Process for Preparing Shaped Articles of Cellulose. No. 2,810,162. Max Frederick Bechtold, Kennett Square, Pa., and James Herbert Werntz, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

A shaped cellulose article is formed from an aqueous particulate dispersion consisting essentially of 1-7 parts of finely divided cellulose whose average particle size is less than 300 microns, and whose DP value is at least 150; plus 19-13 parts of water containing 0-20% by weight of the cellulose of a monomeric dispersing agent. The shaped dispersion is coalesced by contact with a concentrated solution of a monomeric salt at a temperature of 90-150° C., until it is converted to a gel. The coalescing treatment is discontinued before shape is lost, after which it is washed until free of salt and dried.

Resin Laminates and Method of Producing Same. No. 2,810,674. Joseph V. Madden, Culver City, Calif. (to Hughes Aircraft Co., Culver City, Calif.).

Epoxy and phenol aldehyde resins; an epoxy hardening amine; a vegetable oil plasticizer; an inorganic acid to effect equal curing of both resins; and a solvent are combined to form a coating mixture for a plurality of filler material sheets. The coated sheets are stacked and heated to effect impregnation, after which they are cured by the void-free process.

Method of Bonding a Fluorinated Synthetic Resin to Another Material. No. 2,809,130. George Rappaport, Dayton, O. (to General Motors Corp., Detroit, Mich.).

The resin surface to be bonded is subjected to an alkali metal polyaryl hydrocarbon-solvent solution before application of the adhesion cement.

Process for the Production of Artificial Leather from Polyvinyl Chloride. No 2-809,398. Karl Stiehl, Hanau, and Johannes Cornelius Valenteyn, Wolfgang, Kreis Hanau, Germany. (to Deutsche Gold- und Silber-Scheideanstalt vormals Roessler, Frankfurt am Main, Germany).

A high molecular weight organic material, capable of swelling and forming a gel in the presence of water, is incorporated into a pigment and softener, plus containing a PVC composition suitable for the production of artificial leather. The composition is sheeted and heated to effect gelling, after which it is stamped to provide a leather like surface. The high molecular weight organic material is present in an amount approximating 3-20% of the composition.

Method of Manufacturing Nylong Articles Having Improved Dimensional Stability. No. 2,808,622. Louis L. Stott, Wyomissing, and William J. Davis, West Reading, Pa. (to Polymer Corp., Reading, Pa.).

An article is molded from polyamide while at a moisture content of less than 0.5% by weight; heated to a temperature from 450-475° F., slowly cooled to a temperature at least as low as the boiling point of water; and rough machined. The moisture content of the article is raised to a point above the equilibrium value of the humidity conditions under which it is to be used, after which it is reduced to a point where it approximates these conditions and is subsequently finished-machined.

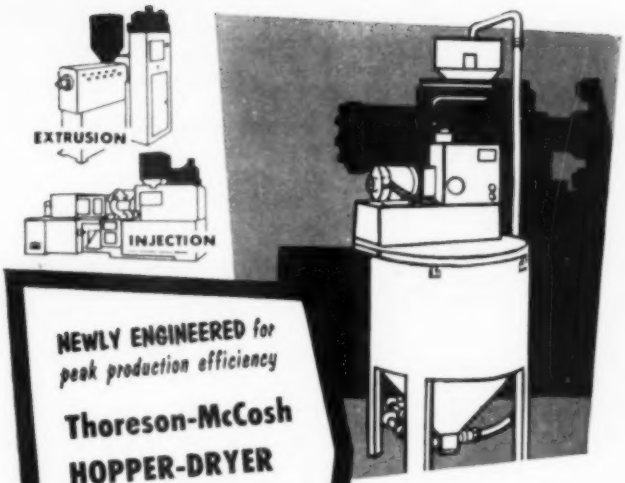
Method for Casting Tubular Members. No. 2,808,623. Newton C. Foster, Pittsburgh, Pa. (to Westinghouse Electric Corp., East Pittsburgh, Pa.).

A process for preparing a tubular member comprises introducing a liquid, polymerizable, resinous composition into a mold cavity containing a centrally disposed mandrel; curing the composition by heating it to a temperature between 60-150° C.; simultaneously passing a coolant through the mandrel to maintain a thin layer of the resinous composition in a liquid form; and removing the resulting solidified member from the mold.

Applications

Plastic Grommet. No. 2,807,850. Frederick Davidson, Boonton, N. J. (to Boonton Molding Co., Boonton, N.J.).

A two-piece plastic grommet, each half of which has a closed annular shell with an open center raised and thickened relative to the edge. A plurality of tenons are molded integrally within each open center and project toward the other half where they form an interlocking engagement. The tenons define an aperture which acts as the tubular shank of the grommet, and the parts are so dimensioned that when the halves of the grommet are pressed together through an aperture in a sheet, the sheet is gripped by the grommet's periphery.



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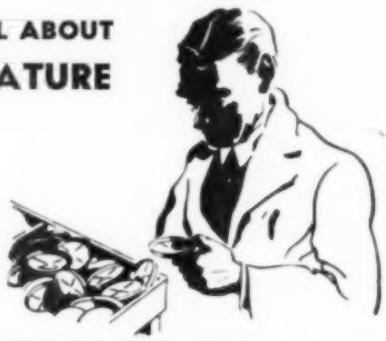

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Industrial News Briefs (Cont'd from p 383)

York, N. Y. Cadillac will carry complete stocks of the resins and hardeners for delivery from its warehouses in Detroit, Chicago, Cincinnati, Cleveland, Dallas, Kansas City, Los Angeles, Milwaukee, St. Louis, and San Francisco, and also will maintain a technical advisory service for epoxy users and dealers.

Diamond Alkali Co., Cleveland, O., is shipping polyvinyl chloride and others of its chemicals in new, improved packages that feature an attractive, uniform "Diamond Family Look." The packages show the company's new, all-embracing trademark and a standard contrasting color combination.

Current Market Prices Price Changes and Additions

Dispersing Agents			
Darvan 1, 2, 3	lb.	$0.22 /	$0.30
7	lb.	.1875 /	.2375
Stabilizers			
Vanstay A	lb.	.51 /	.53
AB	lb.	.47 /	.49
HT	lb.	.88 /	.90
HTA	lb.	.98 /	1.00
HTB	lb.	.71 /	.73
HTC	lb.	1.10 /	1.12
L	lb.	.33 /	.35
R, X	lb.	.68 /	.70
RZ-25	lb.	.67 /	.69
S	lb.	.58 /	.60
SA	lb.	.82 /	.84
W	lb.	1.23 /	1.25
Z	lb.	.63 /	.65

CALENDAR of COMING EVENTS

May 1-8

26th Annual Convention and Tool Show, American Society of Tool Engineers, Convention Center, Philadelphia, Pa.

May 14

SPE New York Section, Plant Tour, W. R. Grace Laboratory, Clifton, N. J.

May 21

SPE New York Section, Governor Clinton Hotel, New York City.
SPE New York Vinyl Group, First meeting — Topic is Stabilization, Governor Clinton, Nyc.

May 26-30

27th Annual National Packaging Exposition, Coliseum, New York City.

June 9-12

1958 Microscopy Symposium, Del Prado Hotel, Chicago, Ill.

June 9-21

Triennial meeting, Intl. Organization for Standardization, Harrogate, England.

June 11-14

National Society of Professional Engineers, Annual meeting, Chase-Park Plaza Hotels, St. Louis, Mo.

June 15-19

Semi-annual meeting, ASME, Hotel Statler, Detroit, Mich.

June 22-27

Annual meeting, ASTM, Hotel Statler, Boston, Mass.

Aug. 4-8

1958 Gordon Research Conferences on Elastomers and Polymers, University of Rhode Island, Colby Junior College, New London, N. H.
SPE Regional Technical Conference, Plastics in Packing, Statler-Hilton Hotel, Hartford, Conn.

October 9-10

14th New England Section Conference, SPI, Wentworth-by-the-Sea, Portsmouth, N. H.

Nov. 5-6

Annual Fall Meeting, Society of Vacuum Coaters, Hotel Statler, Detroit, Mich.

Nov. 17-21

Eighth National Plastics Exposition, Intl. Amphitheatre, Chicago, Ill.

Domestic Production and Sales of Plastics and Resin Material, November and December, 1957

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of November and December, 1957. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

A year ago, the month of December showed a total production of 22-million pounds under that of December, 1957. Sales are down, however—about 4-million pounds. Polyethylene and polyester sales are up; and the drops were most evident in vinyls and phenolics.

	November, 1957		December, 1957	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,309,972	1,211,424	1,372,069	1,332,665
Sheets, 0.003 gage and over	1,731,500	1,702,362	1,673,637	1,449,573
All other sheets, rods, and tubes	611,426	697,781	839,271	670,161
Molding and extrusion materials	7,623,546	7,935,671	7,777,864	7,846,412
Nitrocellulose sheets, rods, and tubes	338,591	323,931	359,716	354,824
Other cellulose plastics	343,936	310,451	258,752	242,099
TOTAL	11,958,971	12,181,620	12,281,309	11,895,734
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	15,808,001	8,922,556	14,684,947	11,442,608
Bonding and adhesive resins for—				
Laminating (except plywood)	4,437,860	3,445,011	3,839,103	2,938,864
Coated and bonded abrasives	1,257,448	1,171,254	1,371,117	1,159,799
Friction materials (brake linings, clutch facings, and similar materials)[7]				
Thermal insulation (fiber glass, rock wool)	3,849,761	3,719,902	3,648,959	3,586,348
Plywood	3,662,573	3,153,883	3,438,804	2,756,143
All other bonding and adhesive uses	5,812,262	5,207,453	4,758,997	4,320,970
Protective-coating resins, unmodified and modified except by rosin	2,389,221	1,786,612	2,149,041	1,578,243
Resins for all other uses	2,940,988	2,430,254	2,636,892	2,104,628
TOTAL	40,158,114	29,836,925	36,527,860	29,887,603
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	3,147,178	2,842,903	3,621,239	2,926,876
Paper-treating and paper-coating resins	1,991,262	1,742,206	1,468,180	1,387,303
Bonding and adhesive resins for—				
Plywood	7,855,371	7,208,250	6,819,196	7,426,694
All other bonding and adhesive uses, including laminating	3,277,642	2,619,470	3,021,989	2,889,671
Protective-coating resins, straight and modified	2,841,313	2,017,452	3,266,673	2,432,706
Resins for all other uses, including molding	6,654,945	7,380,440	8,163,799	7,392,823
TOTAL	25,767,711	23,810,721	26,361,076	24,456,073
Styrene Resins:				
Molding materials[1]	34,823,682	32,167,483	33,216,792	27,658,345
Protective-coating resins, straight and modified	7,471,546	5,918,109	6,770,603	5,731,628
Resins for all other uses	12,987,046	10,199,905	12,685,969	10,009,744
TOTAL	55,282,274	48,285,497	52,673,364	43,399,717
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		5,569,402		4,231,256
Sheeting (resin content)		5,141,662		4,396,143
Molding and extrusion (resin content)		16,939,555		14,001,712
Textile and paper treating and coating (resin content)[3]		6,151,239		3,935,857
Flooring (resin content)		6,224,437		6,176,331
Protective coating (resin content)		1,915,845		2,072,855
All other uses (resin content)		6,211,364		5,345,028
All other vinyl resins for—				
Adhesives (resin content)		3,197,232		2,895,800
All other uses (resin content)		9,264,876		8,291,563
TOTAL	71,535,307	60,615,612	66,458,453	51,346,545
Coumarone-Indene and Petroleum Polymer Resins	19,718,121	19,558,436	18,227,259	16,983,031
Polyester Resins	6,588,956	5,809,090	6,546,316	6,158,214
Polyethylene Resins	62,935,598	58,395,275	68,510,192	53,069,960
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1, 4]	4,742,495	4,430,953	3,838,922	3,380,841
Protective-coating resins[5]	1,183,316	479,489	987,100	416,411
Resins for all other uses[6]	11,303,526	8,508,807	10,902,280	8,247,232
TOTAL	17,229,337	13,419,249	15,728,302	12,044,484
GRAND TOTALS	311,174,389	271,912,425	303,314,131	249,241,361

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7]Included with "All other bonding and adhesive uses."
SOURCE: United States Tariff Commission, Chemical Division.

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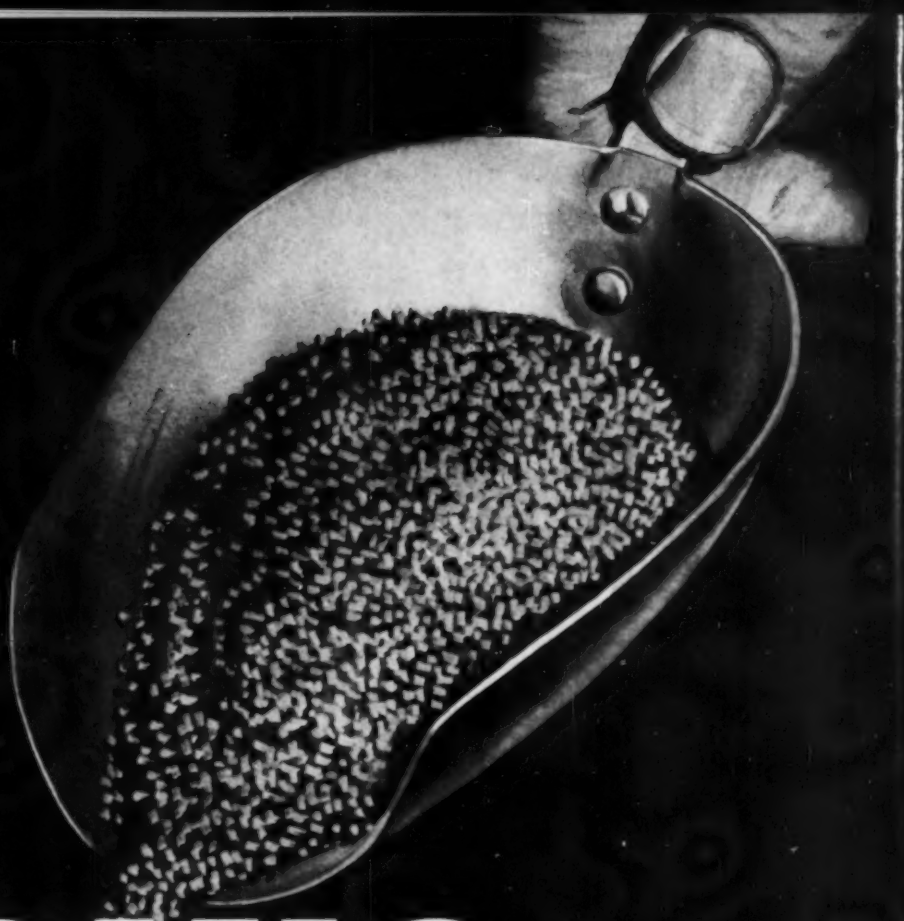

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